

Professional Working Environment Discrepancies in Large Building Projects

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Abstract:

The thesis reveals results of research study on professional working discrepancies in large building projects in the contextual boundaries of Eastern province of Saudi Arabia. To accomplish study objectives, the researcher carried comprehensive literature review of subject through periodicals, dissertations, previous research studies & books written on professional relationships on project interfaces. A detailed study of three most conspicuous large building projects, in eastern province, was carried out to collect actual information about the professional working environment by professionals on project design and construction interfaces.

Responses from the professionals involved in the completion process of the particular projects, the results divulge that *lack of coordination, Insufficient working drawing details, involvement of designer as consultant, involvement of contractor as consultant & participants' honest wrong beliefs* are considered as most important origins of professional dissonances on project design and construction interfaces. Whereas the *project management as individual professional service, nationality of professional firms & involvement of contractor in design phases* are interestingly revealed as least

important origins of dissonances between professionals on project design and construction interfaces in large building projects.

1) **Introduction:**

In the construction industry, the client's (owner) intent is to attain high quality, minimum project completion time and at minimum cost. These three intents are hardly ever achieved utterly because of the fact that these intents are mutually exclusive. The lowest possible cost may corresponds to the low quality and slow progress. Therefore, there must be trade-offs between these goals as they are enforced by the client and as the project conditions demand. The owner, however, ought to clearly define each of the goals, quality could means project appearance, execution precision, strength or compliance with the project plans and specification. The goals once define and manifested by the concern parties would be in better position to respond in the particular direction and it would endow with better line of action for the project completion in utmost excellence attainable.

The successful completion of a building project requires a lucid manifestation of the client's requirements, the nature of the service to be provided, and the responsibilities of all concerned authorities. The concerned authorities in an conventional building project are the Owner, the Designer, & the Constructor.

The Owners (Client) have an important role to influenced the entire project at every phase of the project life cycle. They must provide adequate information on the project, site, budget, project time and should have clear understanding of project's final form as the architect engineer purse to finalized the stipulated design of project. Conventionally, the owners are not much involved in projects various phases, therefore they seems only concerned with the financial aspects of project. Whereas, being the key authority in the project completion scenario, the owner should be involved in every phase

to have very clear manifestation of the project and be available to take necessary action spontaneously to augment the construction or the design phase for completion of entire project.

The Designer's, considering conventional practices, primary professional responsibility is to provide complete stipulated design documents of project with the consent of owner, act as the client's advisor and additionally to administer the building contract fairly between client and contractor (depending on the contract type).

The Contractor (constructor) provides all the relevant construction facilities to carry out the construction of project, which includes the provision of labor force, equipment and carry out the construction of project, which includes the provision of labor force, equipment and material (depends on the contract conditions). Conventional practice in construction industry indicates that constructors and architects don't have mutual working relationship to carryout the project with the essence of synergism.

Fredrickson (1998) expressed, about the interfaces, that each project, each client, and each design-construct delivery team has unique design needs and there is no satisfactory "cook book" method of identifying the right design approach to a particular project. However, the guidelines adopted from previous projects assist a project delivery team to determine how the design should be handled on a project and greatly improve that project's chances of success.

Chalabi (1984) articulated that conflicts between the owner, consultants and contractors are more frequent in projects marked by poor management. Conflicts can be reduced by carefully adhering to procedures set forth in the contract, which may include authorization requests granting approvals, reporting procedures, inspections, regular

meeting, etc. mutual lack of attention to procedures by the owner and several contractors caused management problems.

Mendelsohn (1997) articulates that probably 75% of the problems encountered in the field are generated in the design phase. That is not to say that contractors don't create a slew of problems of their own but that these problems are often compounded by inherent design flaws. If we seriously consider ways to reduce problems in the field, an obvious place to begin is to focus on what project team can do to catch these problems in the design phase.

Roy Mendelsohn (1997) articulated that a Designer has a conceptual mind and a contractor has a concrete mind. One relates to intangibles and the other relates to tangibles.

2) Statement of Issue:

Construction project involves two main professionals in conventional practices of construction industry. These two concerned professionals are the Designer, and the Contractor. Communication for coordination of these parties is the key element to be considered for successful completion of project. It is postulated that dissonances among the concern most active parties initiates barriers in the design phases and construction process.

Eliminating the dissonances which exist in peak intensity, enables the projects to be completed rather successfully. Discords on interfaces of concern authorities either result in delay in project duration, or compromise on quality or increase in cost. Considering these prominent issues which ultimately shape up any construction project, augments the need to have better comprehensive solutions of those discords and to

coordinate on the interfaces. The most important is to figure out the most potential dissonances occur in project life cycle. These potential areas are the actual dissonances which linger the project progress substantially.

3) Research Objectives:

Constitutive objectives in the perspective of research context (Construction industry in Eastern Province of Saudi Arabia) are presented below;

- a. To assess the professional interfaces between Design & Construction.
- b. To identify potential dissonances of Design and Construction common boundaries.
- c. To provide suggested solutions and recommendations to trounce the interface dissonances.

4) Research Methodology:

The research encircles three(03) conspicuous large building projects in eastern province of Saudi Arabia. First of all whole concentration of research is on acquiring the knowledge through extensive literature analysis for developing a questionnaire for research study. Three large conspicuous buildings projects were selected, for better comprehension about the actual professional dissonances. The questionnaire was used as baseline for the study. After the analysis, based on the responses from the professionals on the particular projects. The actual scenario was revealed through the detail discussions with those professionals on the project sites.

5) Results & Findings:

Following projects are selected and considered for detailed analysis, all concerned professionals were individual met and interviewed for in depth comprehension of actual scenario defining the dissonances between designers and contractors.

- 1) **Al-Rashid Tower.** (Al-Khobar).
- 2) **Al-Hussaini Commercial Tower.** (Dammam).
- 3) **Al-Subeaei Commercial Center.** (Al-Khobar).

In the following section, each project is taken separately and described in detail including the extensive analysis of the entire project.

• **Al-Rashid Tower:**

Al-Rashid Commercial tower is a prominent commercial landmark edifice, under construction in Al- Khobar. Following are the basic vital information regarding the project participants;

Project Owner: **Mr. Salah Ali Rashid.**

Project Designer: **Samir Kair Allah (Beirut).**

Project Contractor: **Saudi United Company.**

Project Construction Management: **Universal Cooperation for Industries & Trad.**

Project Profile:

The project is a conspicuous landmark being built in the area of Al-Khobar, it consists of eighteen floors. The building is purely based on modern architectural design and the monumental scale of the edifice would make it the most known landmark of the vicinity. The project is estimated over 25 million Saudi riyals project. There were

mainly three professional bodies involved in the project, the Designer, the Contractor and the Construction management firm. Al-Rashid commercial tower is schedule to be completed by the end of 2003.

Project Questionnaire:

Questionnaire is considered as the base line for gathering information and analyzing the actual scenario. Each dissonance was discussed with the professional individually and the questionnaires were filled by the concern professionals.

Following are the Personnel responded from each participating parties in shaping up the project.

Designer ----- **Senior Architect.**

Contractor ----- **Construction Manager.**

Construction Management ----- **Material Procurement Manager.**

Designer Firm Profile:

The designer firm “*M/S Samir Khairallah & Partners*” is a Lebanese origin firm which has been working in the Kingdom for last fifteen years, the main office is in the area of Beirut, Lebanon. It is a foreign national firm which has worked on various private sector projects. The firm has completed mostly general building projects besides that it has worked on some industrial projects as well. The firm has extensive experience in design consultation.

Contractor Firm Profile:

The Contractor firm “*Saudi United Company*” is a grade 02 contractor, which has been working in the Kingdom for last fifteen years, the main office is in the area of Al-Khobar. It is a Saudi national firm which has worked on various private sector projects

and Government projects. The firm has completed mostly general building projects besides that it has worked on some industrial projects as well, and most of the project were carried out under the Unit Cost contract type.

Construction Management Firm Profile:

The construction management firm on this particular project is basically a contractor firm, which got the responsibility of construction management of the project. The firm is “*Universal Corporation*” is a grade 02 contractor firm. It has been working in Saudi Arabian construction industry for last fifteen years. The nerve center of the firm is in the area of Al-Khobar. It is a Saudi national firm which has worked on various government projects as well as private sector projects. The firm has completed mostly general building projects besides that it has worked on some industrial projects as well, and most of the project were carried out under the fixed lump sum contract type

Following is the detailed expression about each dissonance as responded by the professionals.

1) Involvement of Contractor in Design Conceptual phase:

Considering the particular project, the contractor had no chance to sit along the designer for providing his input in design conceptual phase, because the design was carried out in Lebanon, and the contractor was in Saudi Arabia through out that time frame. Involvement of contractor in design conceptual phase initiate dissonances very significantly, because designers are not accommodating in this respect. Any advise or proposal from contractor, face vigorous opposition from designer with preconceived ideas and notions that contractor is acting always at the opposite direction. Considering

that the involvement of contractor may cause quite a negative impact on design professionals team, whereas the contribution of contractor can be of very useful for developing the design at the conceptual phase, but usually the involvement causes very strong negative impression on participants relationships. (*Contractor*)

Involvement of contractor in design conceptual phase doesn't initiate significant dissonance, because involving contractor assists the designer in developing the most pragmatic design at the conceptual stages. Contractor with cooperative and accommodating nature is a positive addition towards the project development. Therefore the designer and consultant have ranked this origin as not important for initiating any kind of dissonances between professionals on design and construction interfaces. (*Designer, Consultant*)

2) Involvement of Contractor in Design Development Phase:

Involvement of contractor in design development phase doesn't initiate significant dissonance, because involving contractor assists the designer in developing the most pragmatic design through the conceptual to development phases. Considering the particular project, the contractor had no chance to sit along the designer for providing his input in design conceptual phase, because the design was carried out in Lebanon, and the contractor was in Saudi Arabia through out that time frame. Contractor with cooperative and accommodating nature is a positive addition towards the project development. Therefore the designer, contractor and consultant have ranked this origin as not important for initiating any kind of dissonances between professionals on design and construction interfaces. (*Designer, Contractor & Consultant*)

3) Lack of Stipulated Data:

On this particular project, the consultant encountered various stages where the stipulated data was not available and eventually the professionals have to wait for the data to be arrived in Saudi Arabia from Lebanon where the designer was developing the design. Lack of stipulated data is one of potential base for initiating dissonances between designer and contractor, because in absence of stipulated data the participants specially contractor can misunderstood the required job and carry out in the direction opposite to the required one. Lack of stipulated data cannot assist in explaining the design sufficiently. Eventually designer blames the consequences lack of data on contractor and vice versa. Lack of stipulated data is one of the origin for dissonance, because in this case the contractor is in most difficult situation because he is bound to refer to designer again and verify about each missing information about design, eventually that takes a lot of his professional time as well as it also impact the pace of on going work. Ultimately, when contractor ask for compensation for his delay which eventually is the outcome of the lack of information provided by designer initiates serious dissonances between the professionals. Usually the target of lack stipulated data, is the contractor because they are subjected to vulnerable misunderstanding about project demands, therefore the concerned professionals have opted the origin as very important origin of dissonances between professionals on design and construction interface. (*Designer, Consultant*)

Lack of stipulated data is one of the origin for dissonance, because in this case the contractor is in most difficult situation because he is bound to refer to designer again and verify about each missing information about design, eventually that takes a lot of his professional time as well as it also impact the pace of on going work. Ultimately, when

contractor ask for compensation for his delay which eventually is the outcome of the lack of information provided by designer initiates serious dissonances between the professionals. On this particular project, the contractor faced very rarely problems with lack of any stipulated data, usually the data was given and interpreted quite aptly. The contractor opt for this particular origin as not important in questionnaire, based on previous experience on various projects. (*Contractor*)

4) Delay in Construction Documents Preparation:

Considering the particular project, the consultant and contractor had some conflict because of the delay in construction document preparation. Eventually the delay brings the professional at the verge of conflict because there were numerous activities depending on the construction documents which were being delay as the consequences. According to contractor, delay in construction documents preparations brings the professionals at the verge of conflict when the documents are not prepared on time, eventually the professionals have to wait till the preparation and approval of construction documents. Usually the documents are prepared according to the schedule, whereas if not prepared, many basic details regarding the construction requirements are given to the contractor, but it can be interpreted sway from the stipulated demands. (*Consultant , Contractor*)

Delay in the documents preparation, brings the professionals at the verge of conflict because the delay affects the preparation of preparatory works and planning. Construction documents preparation is the major base for any project commencement of work and other processes to accomplish the project according to desired time frame. On this particular project the designer has not encountered any severe delay in documents preparation and eventually it lead the professionals to accommodate their plans

accordingly and conveniently. The Designer consider this origin as somewhat important origin initiating professional dissonances between the designer and contractor. (*Designer*)

5) Lack of Human Resources for Design Firm:

Lack of human resources for design firm is a very potential origin for initiating dissonances, because lack of human resources bounds the design firm to compromise on various aspects of project design. Eventually it produces project design with various and numerous flaws. The flaws are the basic dissonances between the professionals because they have to rectify those and then proceed their work accordingly. Lack of human resources also bound the firm to produce the design at stipulated time frame and eventually it affects the chain of activities which are dependant on the requirement of stipulated comprehensive design of project. On this particular project, the designer firm was quite prompt in completing the design details regarding the project, regardless the huge scale of project the designer was quite successful in conveying the design in detail because they have all the stipulated human resource to deal the project in actual professional depth. The concerned participants, considering their previous professional experience, have ranked this origin as very important origin of professional dissonances. (*Designer, Consultant & Contractor*)

6) Time Limitation in Design Phase:

Time limitation in design phase is a very potential origin of dissonances between professionals. This particular project, participants didn't encounter such problem, because the design process was quite well planned and carried out in the systematic way. The designer consider this as quite potential origin for professional dissonances, because the time limitation bounds the designer to come up with the rather not well developed idea

which eventually leads the professionals away from the actually optimum quality which can be achieved in case of availability of more time to develop the project design. Time limitation in design phase bounds the designer to wrap up the design as not fully developed, if the time is not being followed accordingly. This can initiate professional dissonances between participants, as the information is fully developed to be carried out the construction work according to the design details. The concerned participants have marked this origin as very important origin of professional dissonances. (*Designer, Consultant, & Contractor*)

7) Lack Of Designer Knowledge Of Available Materials & Equipments:

Lack of present knowledge about available materials and equipments, affects the project adversely where the specifications about design are not available then the whole process of defining specifications has to be repeated. Eventually, delaying project or occasionally ends up in vital changes in entire design entity, as it affects the chain of project completion therefore it initiate conflict between the concerned professional for not having the proper source of information and applicable details. If the contractor calls for certain materials or work procedures, then a change order is required to substitute these materials or procedures. Specially in the Saudi environment, where material standardization is not common and where the market is full of all kinds of materials, making a pre-selection of materials is quite difficult. On this project, there were some misunderstandings due to the lack of the update designer knowledge of available materials and equipments, therefore there were material change for façade while the construction phase, because the material required by the designer was not available in the local market, the consultant opted for long lead procurement for the stipulated material

whereas eventually the alternate materials were finalized for edifice façade. The contractor and consultant have ranked it as very important origin, and the designer has ranked it as important origin of professional dissonances. (*Designer, Consultant & Contractor*)

8) Incomplete & Inadequate Plans and Specifications:

Considering this particular project, the Designer didn't encounter this specific problem. The designer has ranked this origin as important origin of dissonances. Because the lack of sufficient knowledge of materials and equipment brings the designer at the verge of quite misleading design information. Incomplete and inadequate plans & specifications are not much helpful in defining the actual extents of design, as from the insufficient plans the contractor can not interpret information in the actual required forms. Eventually that initiates dissonances between the professionals. (*Designer*)

The Contractor and Consultant consider the mentioned origin as very potential origin for initiating dissonances between professionals, regardless on this particular project this particular problem was not encountered by professional but considering their previous experiences and observations they have ranked it as "very important". Incomplete and inadequate plans & specifications are not much helpful in defining the actual extents of design, as from the insufficient plans the contractor can not interpret information in the actual required forms. Sometimes the contractor has to approach the designer for verifications or further explanation about the design which is not given or clarified on the plans and specifications, which eventually takes his professional time and efforts. If the contractor rely on his own perception to complete the uncompleted plans may lead the interpretation of design in quite a different way than required. Eventually this leads to

initiate dissonances between the concerned professionals at job interface. (*Consultant, Contractor*)

9) Insufficient Working Drawing Details:

Considering the particular project, the participants didn't encounter such problem because the designer firm provided the working drawing with sufficient details, where as some minor explanations were further achieved from the firm, eventually there was no particular conflicting scenario based on working drawing details. Insufficient working drawing details brings the contractor at the verge of vulnerable state if he pursues the project with insufficient drawing details it can lead him in the wrong way which might ends up as not the required one or delayed one. Insufficient working details originates quite a significant dissonance between the professional cause the designer would like to get the work done according to his best perception, whereas if he doesn't provide sufficient information on working drawings, the contractor would not be able to comprehend the actual sense of stipulated job. Eventually it is a potential origin of dissonances between the parties. The participants ranked this origin, considering their previous professional experience, as very important origin. (*Designer, Consultant & Contractor*)

10) Insufficient Communication between the Contractor & Designer Dyad:

On this particular project, the contractor didn't encounter very significant gap between communication channels across the professionals and that keeps the project progress on the right track, whereas, occasionally the contractor faced some difficulties in pursuing the designer because of the distance there were not much frequent communications between the dyad. As the designer used to visit the site once a month.

Communication is virtually the back bone of any professional dyad relationship to nurture the development of better opportunities and best outcome from present business. Ways to improve coordination and communication include coordination meetings, progress reports, and conference calls among others. Communication between the contractor & designer is an important aspect to control and mitigate the severe professional dissonances, but if there are design consultant involved in the project then the schism between the designer and contractor can be overcome by the consultants. The contractor has ranked it as very important origin of professional dissonances.

(Contractor)

Communication gap has the tendency to produce very severe results to the project progress. Usually there is quite sufficient communication between the professionals as conventional practice that prevails in construction industry. Communications gap is a potential dissonance origin, because lack of communication leads to misunderstanding of the required job and eventually ends up in adversely affecting the project. Therefore it is ranked as an important origin for professional dissonances. ***(Designer, Consultant)***

11) Lack of Mutual Respect between the Professionals:

Considering the mentioned project, the professionals have very amicable working environment and respect for each others professional decisions for the better completion of project. Lack of mutual respect between the professionals is a social aspect which adversely affects the entire project. For better coordination during the project completion phases, mutual respect plays vital role because through mutual professional respect the participants regards each others decisions and opinions for betterment of entire project. In case of lack of mutual respect between the professionals, they don't usually agree on

amicably on any issue regarding project development. Eventually this brings the professionals at the verge of professional mismanagement for pursuing the project in the stipulated direction for completion, unnecessary delays are very common in this scenario. The Contractor has ranked it as very important origin, where the Designer and Consultant also consider it as an important origin of dissonances at professional interface. (*Designer*)

12) Exotic Design & Technology:

Considering the project as an exotic design, the contractor has bump into some technical instructions which were quite not clear or conveyed, but those were carried out without delaying any activity on construction process. Exotic design needs special explanation to the professionals working in the local market to comprehend the actual stipulated work item. Exotic design is one of the very potential origin of dissonances, because it is quite difficult to fulfill the basic essential requirements in proper way. Lack of coordination and communication and experience in case of exotic design and technology impacts the entire project in disastrous means and eventually affects the whole working environment and its consequences. Exotic design and technology is an origin for potential dissonance, because it needs more attention from both parties as compare to local design and technology in which the participants has already experienced. The contractor feels that it is one of the very important origin of professional dissonances on design and construction interfaces. (*Contractor*)

The consultant has marked it as somewhat important origin whereas the designer considers it as not an important origin, because they perceive that exotic design and technology is not a very potential and important origin of dissonances, the designers and

consultants are quite well known of the required expertise for catering the special need of design and technology. On this particular project, it is considered to be the one of his kind because of the design and the materials, which eventually shaping up the whole form of project. The Designer encountered no difficulty in catering the design with other professionals on this particular project. (*Designer, Consultant*)

13) Ambiguous Design Details:

On this specific project the participants didn't come to any serious scenario due to the design ambiguity, because there were some minor ambiguities which were easily take care off spontaneously. The origin is ranked as the very important, based on the previous professional experience, by the Designer and the Consultant. It is an origin for potential dissonance because there is a possibility of misunderstanding the required work and eventually the work has to be done again and initiate delay in the entire cycle of project completion. Less ambiguity in design detail tends to have more comprehension on the right stipulated track for work done, eventually, it initiate a better work environment for entire professional team with less professional conflicts. Considering the conventional professional practice that prevails in construction industry, the professionals consider that design ambiguity is a common scenario and it should be handled with care and extra explanation about the design details. Design ambiguity is an important origin of dissonances, on this particular project the designer has faced the need for some extra elaboration of some information and details for better manifestation of the stipulated job. The contractor marked the origin as an important origin of professional dissonances between the professionals on design and construction interfaces. (*Designer, Consultant & Contractor*)

14) Lack of Specialized Construction Manager:

The management of job lines are quite easy and possibility of any large scale error is quite eliminates in the presence of construction manager. Construction manager, carries out the construction phase in an organized ways which eliminates the risk of delays and other problems which occurs if the work items are not carried out in organized manner. Considering the particular project, the designer and consultant didn't encounter this specific problem because the contractor had very competent and specialized construction manager on site to manage the on-going works at construction job site. Based on the previous experience, the participants has ranked this origin as "very important" origin of dissonances. (*Designer, Consultant & Contractor*)

15) Material Changes during Construction Phase:

Material changes in types and specifications are the one which are based on the personal propensity to create change in overall design impact, therefore this origin is different from the shortage of material cases. On this particular project, the contractor has faced quite a lot problem in this very issue, because during the construction phase, there were quite numerous changes in materials were taken by the participants. The materials for flooring and other finishes were twice changed after the arrival of material on the site. Eventually that brought the professionals at the verge of conflict because the contractor blames the designer for such changes, on the other hand, designer was not inclined to suggest any compensation for contractor and the delay of his activities due to the changes. Material change in specifications and types is a very frequent activity observed in the construction of this particular project. During construction phase, the change in specifications and types eventually affects the chain of project completion because for

better analysis of the new material require some time from professional for which the on going jobs have to be delayed. It is one of the major changes which contractor has to accommodate and also provide time to the designer to go through the design analysis according to the new material type and specifications. The designer and the contractor has marked the origin as “very Important” origin, based on the previous professional experience. The consultant ranked it as “important” origin of professional dissonances. (*Designer, Consultant & Contractor*)

16) Shortage of Construction Materials:

Shortage of construction material leads sometimes the design change or requires the professionals to review the design with new material which eventually be the replacement of the previously selected and studied one. It is purely a procurement problem, but it affects the entire chain of project completion phases. Considering the particular project the participants didn't face very problem. Based on the previous project experience the contractor and consultant have ranked this origin as one of the vital origins. Occasionally the shortage of material tends to change the design to accommodate the new material as the replacement for the previous one on which the design is already been developed, It initiates dissonance between designer and contractor because eventually the participants blame the delay or compromise, which they have to accommodate, on each other. Due to the shortage of material the participants have to accommodate and compromise for their design which eventually not the best and optimum outcome of their efforts. The concerned professionals ranked this origin as “very important” origin for initiating dissonances on project interfaces. The designer marked it as “important” origin of professional dissonances. (*Designer, Contractor & Consultant*)

17) Design Errors:

The design errors are eventually the responsibility of the design development team, whose repercussions impacting the entire project usually in increase in cost to overcome those errors. Designer is the one to be blamed for this hindrance in the development of project. Eventually the errors are faced and encountered by the contractor and it provides quite a hard time for contractor to accommodate and keep the pace of project unharmed. Design errors which are not taken care of in the design development phase, eventually these errors occurs in construction phase and their impact is much more severe than in the design phase diagnosis. The contractor and consultant have ranked the origin as “very important” origin of dissonances between professionals on design and construction interfaces. (*Contractor, Consultant*)

Considering the particular project, the design of the project was quite comprehensive and well developed. There were no major design errors, eventually that assists the professionals to keep the pace of project as they expected. The design errors are the responsibility of the design development team, whose repercussions impacting the entire project usually in increase in cost to overcome those errors. The designer consider this as important origin of dissonances between professionals, because the other participant doesn't allow time to figure out the design errors and to rectify those incase of any occurrence. The designer has ranked it as “important” origin of dissonances. (*Designer*)

18) Procurement Delays:

Procurement delay may have the tendency to bring the professional at the verge of rework for the project, as the required materials are not available then eventually the professional has to compromise based on the consent of all participants of projects.

Procurement delays is one of the origin of potential dissonances, because procurement delay has various serious after effects on the other dependant processes of construction in the entire chain of project completion. On the particular project, the participants didn't come across such problem because of the systematic approach which was being followed through out construction activities planning and scheduling. The designer and consultant have ranked the origin as "important" origin. (*Designer, Consultant*)

Procurement delay may have the tendency to bring the professionals at the verge of rework for the project, as the required materials are not available then eventually the professional has to compromise based on the consent of all participants of projects. Procurement delays sometimes come up with the entire change or replacement for the actually stipulated materials or equipments for the project Eventually the participants blame others for the delay and demand that the procurement delays should be accommodated by the other professionals so that the actual delay can be reduced by any means. The contractor marked the origin as "very important" origin of professional dissonances on the design and construction interfaces. (*Contractor*)

19) Material Approvals:

Material approvals is an origin for potential dissonances, considering conventional practices in construction industry, it takes quite a long time for approval and eventually it hinders the project pace. Material approvals the process takes too long and the contractor has to interrupt the construction process to get approval of materials, eventually it leads to professional conflicts because each participants require to complete his part of project as soon as possible. On this particular project, the contractor had encountered various stages of delays due to the approvals of new materials, eventually the contractor supposed

to reschedule the activity and wait till the material arrives at site. That brought professionals on conflict scenario, the dissonances were settled spontaneously and contractor had received some compensations for accommodating the changes and the delay to get the approvals accordingly. The consultant and contractor have ranked this origin as “very important” origin, the designer also consider the origin as “important” origin of professional dissonances on design and construction interfaces. (*Designer, Consultant & Contractor*)

20) Lack of Coordination between Dyad:

The coordination between the designer and the contractor on this particular project was quite professional and sufficient, whereas on some stages the contractor had faced some problems while referring to the designer regarding the changes and other relevant issues. Lack of coordination between dyad initiates professional conflicts and eventually impacts the project adversely, as lack of coordination tends to augment the errors which usually can be resolved before they affect the project in any respect. Designer and contractor should have professional coordination between themselves, because through the project completion they have to work at different interfaces of project processes. The contractor and the consultant have marked the origin as “very important” and the designer has ranked it as “important” origin of professional dissonances. (*Designer, Contractor & Consultant*)

21) Errors during Field Construction:

Errors during field construction are usually the consequences of design flaws, sometime the errors occurs due to some technical flaws during the construction on site. Errors during field construction is quite a frequent problem prevails in conventional

practice in construction industry. These errors includes various types having the range of human errors to weather and other unpredictable errors. The designer expects this dissonance to be occur quite often. They ranked the origin as very important origin of dissonances between professionals. Errors during field construction is quite a frequent problem prevails in conventional practice in construction industry. These errors includes various types having the range of human errors to weather and other unpredictable errors. It is an origin for potential dissonances, if the coordination between the participants is not professional, then the dissonances are quite influential with adverse consequences. On this particular project, the participants didn't face any severe errors during the field construction onsite, occasionally there were minor errors which were quite amicably and sophisticatedly rectified by the professionals. The contractor and designer have marked the origin as "very important" , and the consultant considers it as "important" origin of professional dissonances. (*Designer, Contractor & Consultant*)

22) Lack of Specialized Human Resources:

Lack of specialized human resource brings the professionals at the verge of intense dissonances, on this particular project human resources are quite specialized in their field. Lack of skilled human resources is one of the major origins for potential dissonances, because in certain jobs may require certain expertise that is not available in the local market and for that reason the consultant may agree to modify the method or procedure of construction. This type of change is more likely to occur in construction involving some degree of technological complexity, whereas in conventional building projects there is not much intense need for specialized human resources. All participants in this

particular project have marked the origin as “very important” origin of professional conflicts between participants. (*Designer, Contractor & Consultant*)

23) Designer’s Lack of Awareness about ongoing Construction Process:

The contractor and the designer on this particular project believes that it is very integral part of any project completion process to keep the designer aware about the on-going construction activities so that if there is any sway activity or interpretation of design details, can be notified as quickly and spontaneously as possible. Designer as the active participant of the entire project completion process, should be kept aware about the on-going construction process, it assists to overcome the problems in their initial stages with less severe impact on the entire project. On this project, the designer was promptly informed about the changes or any modifications on construction site from the actual design developed by the designer, it assisted the professional to keep the work force on the right track and to achieve the actual goal which is perceived and conceived by the project designer. The contractor has marked the origin as “very important” and the designer ranked it as an “important” origin of professional dissonances. (*Designer, Contractor*)

Lack of awareness about the on-going construction project, leads the designer and the contractor towards dissonances, because if any errors occur in construction site and if not reported to designer on time then the problem can turn out to be disastrous for entire project at the later stages of errors impacts. The consultant is convinced that in the presence of consultant which eventually managing the ongoing construction and they keep the track of activities therefore if the designer is not aware of on going construction process it doesn’t initiate any dissonance between the professionals working on project

pace. It is ranked as “not important” origin of dissonances between project participants.

(Consultant)

24) Contractor’s Lack of Comprehension of Drawing Details & Specs.:

Comprehension of drawing details and specifications is the basic key for any project to be interpreted in the stipulated way. Drawing details are the only means to comprehend the project, and before the inception of construction all the information from drawings should be interpreted to get complete comprehension. Contractor’s lack of comprehension in reading and interpreting the actual information from drawings and specifications, leads him to continue the project according to his wrong perception, eventually it initiate dissonance between the participants and impact the project adversely. Considering the project, the contractor is quite capable and qualified of interpreting the actual information from drawings. Therefore they don’t encounter this dissonance, and based on their experience the Designer ranked it as “important” origin. The contractor and the consultant considers it as “very important” professional dissonances on design and construction interfaces. *(Designer, Contractor & Consultant)*

25) Involvement of Designer as Design Consultant:

The contractor ranked this origin as somewhat important respectively, the professional considers it as initiator of dissonances because the designer can be bias on his particular job lines. The contractor consider it as “not important” origin, because they conceive that if the designer himself is design consultant on the particular project is conventional practice in construction practice it doesn’t bring the professional any severe conflicts. Specially on the particular project the designer was itself design consultant, and

the relationship was not suffered any dissonances because of the bias nature on any issues of design to cover their own responsibilities. (*Contractor*)

In case of designer as design consultant, there is possibility that the designer would cover his faults and blame it to other participant. In this case, the owner is in vulnerable condition and cannot be safe from designer's errors and eventually the designer in this scenario can hide his flaws and blame it on other participants. Involvement of Designer as design consultant is an important origin for potential dissonances because if the designer as design consultant strive to overcome their design errors and blame those on the contractor, there is quite significant possibility for the contractor to face resistance in pointing out the design errors or ineffective design specifications. The Designer ranked it as "very important" origin. The consultant also considers it as "important" origin of professional dissonances. (*Designer, Consultant*)

26) Contractor's lack of Sufficient Knowledge:

On this particular project, the professionals are all well qualified and experienced with the sort of undergoing project. Therefore they didn't encounter such problem during the project. Contemporary knowledge about new materials and equipment, is an influential factor in shaping up the entire project specifically during construction phase. Lack of present knowledge about available and new materials and equipments, affects the project adversely because the contractor is not aware of new technology therefore unable to pursue for that project. Eventually, delaying project or occasionally ends up in vital changes in entire design entity, as it affects the chain of project completion therefore it initiate conflict between the concerned professional for not having the proper source of information and applicable details. The Designer ranked it as "important" origin of

dissonances, based on the experience in construction industry, the contractor and the consultant have marked this origin as “very important” origin of professional dissonances. (*Designer, Contractor & Consultant*)

27) Design Complexity:

Design complexity is the factor which affects the project chain in the design as well as construction activities phases. The consultant has ranked this origin as somewhat important origin of dissonances between professionals, because they consider that while dealing with complex design, the participants have to flow the information in quite in-depth level. Which eventually brings the professional to some extent of conflict when one doesn't comprehend the design as in the real sense. Complexity of design requires skilled professionals to deal with it, as well as design complexity is difficult to handle as it is not in linear formats. Complexity also impacts the flow of construction activities as simple and linear construction works is easy to handle, complex design leads to loss of productivity, eventually it initiates dissonances between the designers and contractors in handling the complex design. This project is a complex design project, but it was well developed and conveyed by the professionals, therefore the professionals didn't encounter such problem. (*Consultant*)

The specific project is consist of bit complex design, as it was well defined and manifested by all the concerned participants. Therefore the participants didn't face any problem in carrying out the project in the most optimum and stipulated way. The designer and the contractor considered the design complexity as “very important” origin of dissonances, because according to their previous experience it requires quite an aptness which eventually is not usually practiced in construction industry. While

considering the previous experience the designer and the contractor convinced with idea of design complexity produce hard time for contractors to work on and to manifest the design as the designer would like to convey. (*Designer, Contractor*)

28) Buildability:

The concerned professionals have marked it as “important” origin of dissonances because it is difficult job to bring various professional at one decisions amicably, each participant has its own opinion and they take quite a long time to convince each other on various aspects of project under buildability study. Buildability is the integration of various professional expertise, therefore it has the tendency to be generating interface where dissonances occurs between professionals. It is an origin for potential dissonances during both phases of construction and design in the entire chain of project completion. It is the integration of construction expertise into planning and design of a project so that the construction forces have the maximum opportunity to deliver the project in conformity with cost, quality, schedule and safety objectives of the project’s stakeholders. (*Designer, Contractor & Consultant*)

29) Building Codes:

Codes such as environmental codes are revised periodically and the designer and contractor are requested to accommodate those according to the need in the project. Usually in this case, the accommodation of various changes are quite difficult with participants as they carry out the work according to their own already worked out schedules and job plans. Conventionally, the designers insure that their design is in compliance with these codes. However, new regulations may be issued between design and construction and may force some changes to the original plan. The concerned

professionals have ranked it as “important” origin of dissonance for design and construction interface (*Designer, Contractor & Consultant*)

30) Governmental Regulations:

Government regulations, as an influential factor of project, is an origin for potential dissonance, local authorities may have specific codes and regulations that must be accommodated in design and pursue in construction of project. Conventionally, the designers insure that their design is in compliance with these codes. However, new regulations may be issued between design and construction and may force some changes to the original plan. Codes such as environmental or labor codes are revised periodically and the designer and contractor are requested to comply. The concerned professionals have marked it as “important” origin. (*Designer, Contractor & Consultant*)

31) Lack of Professional Experience & Judgment:

Lack of professional experience is one of the most influential origin for potential dissonances, because lack of experience leads the professional toward more liable to risk of errors on design as well as on the site activities. In case of lack of professional experience of one participant affects the jobs of other professional, eventually initiating dissonances between the concerned professionals. The designer and contractor have considered this origin as the “important” origin, because lack of professional experience leads the participants to the verge of misunderstanding about the stipulated job line. The consultant has marked the origin as “very important” origin of professional dissonances on design and construction interfaces. (*Designer, Contractor & Consultant*)

32) Project Delivery System:

The consultant ranked the origin as “very important” origin, because of different perception of each participants according to the different types project delivery systems. Project delivery systems have its own significance according to the basic philosophy of each delivery systems. For instance, lump sum type, contractor may pursue the project to save as much money as he could, and for that he may go for some compromise on quality and techniques to save money. Eventually, it initiates various dissonances between designer and contractor because of difference in goals. Based on the previous professional experiences, the designer and the contractor have marked the origin as “important” origin of professional dissonances. (*Designer, Contractor & Consultant*)

33) Obstinate Nature of Participants:

Considering the particular project, the participants don't consider each other as obstinate in nature therefore they accommodate each other's opinion quite amicably. The concerned professionals have marked the origin as “important” origin of dissonances on project interfaces between professionals. Participants with obstinate nature would not accommodate each others even creative and beneficial ideas. Eventually, it initiates dissonances between the professional on project interfaces. For successful completion any project, needs amicable working environment which eventually can be achieved by compromising nature of participants, if the participants are irrationally rigid about their professional decisions then the dissonances are very much expected to occur during various project interfaces. (*Designer, Contractor & Consultant*)

34) Honest Wrong Beliefs:

Honest wrong belief of participants can be adversely affecting the project when the participants are of rigid nature and bound to their perceptions. It is one of the major hindrance for project pace. This occurs when contractor and designers, without having first hand knowledge, make decisions based on assumed user needs. Eventually, honest wrong belief is one of the major origin of potential dissonances between designer and contractor on project interfaces. Considering the particular project, the professionals didn't encounter any such problem, because the participants were quite well qualified about the technology and processes for project completion. The concerned professionals have marked it as "important" origin of professional dissonances. (*Designer, Contractor & Consultant*)

35) Economic Situation:

On the micro level of construction industry on a construction project if the economic condition of participants are not similar or somewhat sustainable then their goals would be varying accordingly, which eventually initiates conflict and discrepancies between participants on project interfaces. Economic situation of the entire country affects the construction processes and activities directly in the region. The professionals have marked it as "important" origin of professional dissonances. (*Designer, Contractor & Consultant*)

36) Fast Track Construction:

Fast track construction requires quite a sophisticated and organized system to carry out all the jobs which are interrelated with each other, it affects related activities if one activity delays it affect the other construction activity and the it goes on like snow ball

phenomenon. Therefore it is an origin for dissonances between professionals. Considering the particular project, it isn't a fast track construction project. Therefore the professionals didn't have any chance to experience the particular approach and relevant dissonances. The designer and contractor have ranked it as "important" origin of professional dissonances. (*Designer, Contractor*)

Fast track construction is a systematic way to be followed by the professionals to complete the project as stipulated by the participants. Usually the fast track construction requires bit expertise of professionals, which usually the professionals sustain. Therefore the contractor has marked the origin as "somewhat important" origin of professional dissonances. (*Consultant*)

37) Weather Conditions:

Weather conditions are the aspects which usually considered and well planned , before the construction activity begins. Therefore the contractor and consultant consider this origin as not important origin of dissonances between professional on design and construction interfaces. On the particular project the professional didn't encounter any such problem relevant to weather conditions and its impacts on construction activities. (*Contractor, Consultant*)

Weather conditions impact on construction activities, has the tendency of initiating dissonances because when weather condition varies the contractor has to use some special precautions and on the designer's part those weather condition plays vital role in shaping up the entire design. If contractor is using a technique due to weather condition which was not worked out in the past, it finally initiates some minor conflict between

them. The designer ranked this origin as “important” origin of dissonances between concerned participants. (*Designer*)

38) Nationality of Firms:

Different nationality of participants has the tendency to be an origin of dissonances, because having different nationality would cause them communication problems and even problem in responding to various jobs in different ways as well as it affects the productivity of participants. The professionals consider it as an important origin of dissonance because of the conventional practices in construction industry of kingdom, as most of the labor and other human resource is from various other countries and on various situations they face communication and practices gaps. The designer has marked it as “very important” origin and the contractor marked it as “important” origin of professional dissonances. (*Designer, Contractor*)

On the particular project, the whole labor force and the professionals were from various nationalities. Whereas the professionals were quite competent in handling the professionals matters regardless of the previous experience in their own local environment. There were some dissonances due the labor force having the background of various different nationalities, and they were quite used to carry out the job in their own traditional ways of construction activities. The contractor, considering the previous professional experience, marked the origin as “somewhat important” origin of dissonances. (*Consultant*)

39) Change Orders:

Change orders in any construction project is a usual conventional practice, the additional charges for any change orders is the main issue which eventually initiates

dissonances between professionals on the design and construction interfaces. All the concerned professionals on this particular project consider the origin as important origin of dissonances, based on the previous project experience. There are various reasons for change order in construction project completion processes. It is an origin for potential dissonances because when ever a change order occur that would be settle down with some additional or less cost eventually affecting the goals of participants and project completion chains. The designer has marked the origin as “very important” and the contractor and consultant have marked it as “important” origin. (*Designer, Contractor & Consultant*)

40) Preparation & Approval of Shop Drawing:

Preparation of shop drawings and its approval was carried out by the professionals on this project quite systematically, where as on some stages the approval of shop drawings were bit delayed because of the designer who were not available very frequently. Generally the shop drawings were prepared using most sophisticated software and with extensive details about project particular activities were elaborated. Mainly the problem were faced in getting approvals for shop drawings regarding the material specification and joint detailing on the façade of the project building. Preparation and approval of shop drawings is one of the most integral practice for carrying out the project activities as an organized and systematic way. This is an origin for dissonances because preparing of shop drawings need skilled people and approval of drawings require interactions between professionals, and if there is any delay in approving those shop drawings from designer or require revising the drawings for long time causes dissonances between concerned participants. The designer and consultant have marked it as “very important” origin, and

the contractor ranked it as “important” origin of dissonances between professionals. *(Designer, Contractor & Consultant)*

41) Personal Conflicts between Professionals:

Project completion with successful goals, is the consequences of the optimum professional amicable working environment, if the professionals are not working in amicable and professional environment then they won't be able to produce the stipulated results from the activities. Better coordination during the project completion phases, with no personal conflicts, plays vital role because through mutual professional respect the participants regards each others decisions and opinions for betterment of entire project. It is an origin of dissonances between professional working on project interfaces. Personal conflicts between professionals causes them to act in the opposite way as much as possible, personal conflicts and disrespect between the professionals are social aspects which adversely affect the entire project. On this particular project, the professional didn't encounter severe problem regarding this issue prevailing in the professional environment. There were some minor conflicts which were strictly professional duties oriented, which were settled spontaneously. The professionals were quite experience and were aware of the reality that if they have any personal conflicts which they consider to be important would cause their productivity quite adversely. Therefore the consultant has ranked the origin based on the conventional practice, as they marked the origin as “very important” origin of dissonance. The designer and contractor marked it as “important” origin of dissonances between professionals on design and construction interfaces. *(Designer, Contractor & Consultant)*

42) Unforeseen Problem:

Considering the particular project, professional didn't face any such unforeseen problem. The contractor and designer consider it as "important" origin of dissonances based on the conventional practice of construction industry. Unforeseen conditions is an issue which usually faced by the construction participants, if these conditions are not solved spontaneously may cause quite a major conflict between professionals. In case of unforeseen problems if the participants are not ready to accommodate each others liabilities then it initiates dissonances between project professionals on interfaces. The consultant has marked it as "somewhat" important origin, based on their previous professional experiences. (*Designer, Contractor & Consultant*)

43) Design Omission:

Considering the specific project, there were no design omissions activities rather there were some design additions. In the design development phase, the project was consist of two elevators in the central lobby, eventually the elevator numbers were increases due to the consideration of future utilization expansion of project. On this particular project, the professionals didn't encounter such problem. Conventionally design omissions require every professional to work over it and come up with new adjustment according to the new change in project design. It initiates dissonances between professionals depending on their perception and targets from projects. Change in design may occur when the design is reviewed by the designer. All the professionals have marked it as "important" origin of dissonance between professionals. Eventually it brings the professional on some conflicting grounds, that took some time to pacify those and reschedule the activities according to the new design requirements. (*Designer, Contractor & Consultant*)

44) Involvement of Contractor as Consultant:

On the particular project the consultant firm is basically a contractor firm who also caters the consultation activities for various projects. The consultant has carried out numerous other large building projects in the vicinity and they experienced that there is not risk or harm involved in designating the contractor as consultant, as far as the contractor is acting as an individual professional body on the project and not acting as the civil or any other services contractor. Involvement of contractor as consultant is the conventional professional practice in construction industry. The consultant perceives that if the contractor is assigned as consultant there won't be any severe dissonances based on that selection. There are very rare possibilities of dissonances based on the contractor being bias about his own responsibilities. The consultant has ranked it as “not important” origin of professional dissonances. (*Consultant*)

In case of designating the same contractor who is providing other services for the particular project, involvement of contractor as consultant is an origin for potential dissonances because if the contractors as consultant strive to overcome their construction errors and hide those errors or over cost the activities then keeping the project on the right track and getting the best out of that becomes very difficult. Eventually there is possibility for the designer to face resistance in rectifying the construction according to stipulated design and specifications. In case of contractor as consultant, there is possibility that the contractor would cover his faults and blame it to other participant. The designer and contractor have marked the origin as “important” origin of dissonances between the professionals on design and construction interfaces. (*Designer, Contractor*)

45) Project Construction Management As Individual Professional Service:

Project construction management as an individual service brings professionals at an amicable working environment which eventually lessen the dissonances between concerned participants. In this case there is minimum risk for professionals to blame other professional for any problem in project completion chains. The contractor and consultant considered it as “not an important” origin because they feel that as an individual professional service it provides better opportunity for professional to work most neutral way. The contractor has ranked it as not important origin. Whereas considering the designer’s point of view, Project construction management as an individual professional service is a better way to accomplish a project with minimum dissonances between professionals but there are possibilities of causing project management professionals to spend considerable time to comprehend the project and its extents, before they plan out the management strategies for project completion. The Designer has ranked this origin as important origin of dissonances. (*Contractor, Consultant & Designer*)

- **Al-Hussaini Commercial Tower.**

Al-Hussiani Commercial tower is a prominent commercial edifice, already constructed and functioning productively in Damman. Following are the basic vital information regarding the project participants;

Project Owner: **Mr. Muhammad Adil Al-Hussaini.**

Project Designer: **Saudi Designers Engineering Consultants.**

Project Contractor: **Saudi Wiemer & Trachte Ltd.**

Project Profile:

The project is a high rise building consist of Eight floors, occupied by various firm offices. The building is purely based on modern architectural design. The project was completed as an estimated over 20 million Saudi riyals project, located in Damman. There were mainly two professional bodies involved in the project, the Designer who acted also as Design consultant , and the Contractor. Al-Hussaini commercial tower was completed in 1998, and serving the users since then quite satisfactorily.

Project Questionnaire:

Questionnaire is considered as the base line for gathering information and analyzing the actual scenario. Each dissonance was discussed with the professional individually and the questionnaires were filled by the concern professionals.

Following are the Personnel responded from each participating parties in shaping up the project.

Designer & Consultant ----- **Technical Manager.**

Contractor ----- **Project Manager.**

Designer Firm Profile:

The designer firm “*Saudi Designer Engineering Consultants*” has been working in the Kingdom for last fifteen years, the main office is in the area of Dammam. It is a Saudi national firm which has worked on various private sector projects. The firm has completed mostly general building projects besides that it has worked on some industrial projects as well. The firm has extensive experience in design consultation.

Contractor Firm Profile:

The Contractor firm “*Saudi Wiemer & Trachte Ltd*” has been working in the Kingdom for last fifteen years, the main office is in the area of Dammam. It is a Saudi German joint venture firm which has worked on various private sector projects. The firm has completed mostly general building projects besides that it has worked on some industrial projects as well, and most of the project were carried out under the fixed lump sum contract type.

Following is the detailed expression about each dissonance as responded by the professionals.

1) Involvement of Contractor in Design Conceptual phase:

The designer on this particular project had some initial meetings with contractor to get his opinions and positive suggestions regarding the project conceptual development. It was quite useful in developing the project in the conceptual phase, and designer utilized the creative ideas of contractor. Involvement of contractor in design conceptual phase doesn't initiate significant dissonance, because involving contractor assists the designer in developing the most pragmatic design at the conceptual stages. Contractor

with cooperative and accommodating nature is a positive addition towards the project development. Therefore the designer and contractor have ranked this origin as not important for initiating any kind of dissonances between professionals on design and construction interfaces. (*Designer, Contractor*)

2) Involvement of Contractor in Design Development Phase:

The meetings with contractor to get his opinions and positive suggestions, carried out from conceptual phase to design development phase . It was quite useful in developing the project, and designer utilized the creative ideas of contractor. Involvement of contractor in design development phase doesn't initiate significant dissonance, because involving contractor assists the designer in developing the most pragmatic design through the conceptual to development phases. Contractor with cooperative and accommodating nature is a positive addition towards the project development. Therefore the designer and contractor have ranked this origin as not important for initiating any kind of dissonances between professionals on design and construction interfaces. (*Designer, Contractor*)

3) Lack of Stipulated Data:

Lack of stipulated data is one of potential base for initiating dissonances between designer and contractor, because in absence of stipulated data the participants specially contractor can misunderstood the required job and carry out in the direction opposite to the required one. Lack of stipulated data cannot assist in explaining the design sufficiently. Eventually designer blames the consequences lack of data on contractor and vice versa. Usually the target of lack stipulated data, is the contractor because they are subjected to vulnerable misunderstanding about project demands, therefore the designer opt for this particular origin of dissonance as important origin . (*Designer*)

Lack of stipulated data is one of the origin for dissonance, because in this case the contractor is in most difficult situation because he is bound to refer to designer again and verify about each missing information about design, eventually that takes a lot of his professional time as well as it also impact the pace of on going work. Ultimately, when contractor ask for compensation for his delay which eventually is the outcome of the lack of information provided by designer initiates serious dissonances between the professionals. On this particular project, the contractor faced very rarely problems with lack of any stipulated data, usually the data was given and interpreted quite aptly. The contractor opt for this particular origin as the somewhat important in questionnaire, based on previous experience on various projects. (*Contractor*)

4) Delay in Construction Documents Preparation:

Construction documents preparation is the main activity for any project to be proceeded at the first place. It is an important and intense origin for professional dissonances between designer and contractor. Because according to designer, delay in construction documents preparations brings the professionals at the verge of conflict when the documents are not prepared on time, eventually the professionals have to wait till the preparation and approval of construction documents. Usually the documents are prepared according to the schedule, whereas if not prepared, many basic details regarding the construction requirements are given to the contractor, but it can be interpreted sway from the stipulated demands. On this particular project the designer doesn't face any problem of delay in construction documents preparation, and ranked this origin as important based on the previous experience of various large projects. (*Designer*)

Construction documents preparation is the major base for any project commencement of work and other processes to accomplish the project according to desired time frame. Any delay in the documents preparation, brings the professionals at the verge of conflict because the delay affects the preparation of preparatory works and planning. On this particular project the Contractor has not encountered any severe delay in documents preparation and eventually it lead the professionals to accommodate their plans accordingly and conveniently. The contractor consider this origin as somewhat important origin initiating professional dissonances between the designer and contractor.

(Contractor)

5) Lack of Human Resources for Design Firm:

On this particular project, the designer firm was quite prompt in completing the design details regarding the project. The designer ranked this origin as an important origin based on the previous professional experience. Lack of human resources for design firm is a very potential origin for initiating dissonances, because lack of human resources bounds the design firm to compromise on various aspects of project design. Eventually it produces project design with various and numerous flaws. The flaws are the basic dissonances between the professionals because they have to rectify those and then proceed their work accordingly. Lack of human resources also bound the firm to produce the design at stipulated time frame and eventually it affects the chain of activities which are dependant on the requirement of stipulated comprehensive deign of project.

(Designer)

On this particular project, the contractor doesn't encounter this particular dissonance because the design firm was quite prompt in completing the design details regarding the

project. The contractor ranked this origin as somewhat important origin based on the previous professional experience. Lack of human resources for design firm is a potential origin for initiating dissonances, because lack of human resources bounds the design firm to compromise on various aspects of project design. Eventually it produces project design with various and numerous flaws. Lack of human resources also bound the firm to produce the design at stipulated time frame and eventually it affects the chain of activities which are dependant on the requirement of stipulated comprehensive deign of project.

(Contractor)

6) Time Limitation in Design Phase:

Time limitation in design phase is a very potential origin of dissonances between professionals. This particular project, participants didn't encounter such problem, because the design process was quite well planned and carried out in the systematic way. Based on the previous project experiences, the designer ranked this origin as the highest intensity on questionnaire. The designer consider this as quite potential origin for professional dissonances, because the time limitation bounds the designer to come up with the rather not well developed idea which eventually leads the professionals away from the actually optimum quality which can be achieved in case of availability of more time to develop the project design. *(Designer)*

On this particular project, the contractor doesn't encounter this particular dissonance because the design firm was quite prompt in completing the design details regarding the project. The contractor ranked this origin as somewhat important origin based on the previous professional experience. Time limitation in design phase bounds the designer to wrap up the design as not fully developed, if the time is not being followed accordingly.

This can initiate professional dissonances between participants, as the information is fully developed to be carried out the construction work according to the design details. Usually the design firms are quite capable of completing the design details within the time constraints. (*Contractor*)

7) Lack Of Designer Knowledge Of Available Materials & Equipments:

Materials and equipment knowledge to develop the design in the actual scenario is very vital in defining the project according to the required demands. The contractor ranked this origin as not important origin of initiating dissonances. The particular problem was not encountered on the project. Lack of present knowledge about available materials and equipments, affects the project adversely where the specifications about design are not available then the whole process of defining specifications has to be repeated. Eventually, delaying project or occasionally ends up in vital changes in entire design entity, as it affects the chain of project completion therefore it initiate conflict between the concerned professional for not having the proper source of information and applicable details. (*Contractor*)

The designer considers this origin as very important origin of dissonances between professionals on design and construction interface. Lack of present knowledge about available materials and equipments, affects the project adversely where the specifications about design are not available then the whole process of defining specifications has to be repeated. Eventually, delaying project or occasionally ends up in vital changes in entire design entity, as it affects the chain of project completion therefore it initiate conflict between the concerned professional for not having the proper source of information and applicable details. If the contractor calls for certain materials or work

procedures, then a change order is required to substitute these materials or procedures. Specially in the Saudi environment, where material standardization is not common and where the market is full of all kinds of materials, making a pre-selection of materials is quite difficult. The designer ranked this potential origin of dissonances as “very important” based on previous project experiences. (*Designer*)

8) Incomplete & Inadequate Plans and Specifications:

Incomplete and inadequate plans & specifications are not much helpful in defining the actual extents of design, as from the insufficient plans the contractor can not interpret information in the actual required forms. Sometimes the contractor has to approach the designer for verifications or further explanation about the design which is not given or clarified on the plans and specifications, which eventually takes his professional time and efforts. If the contractor rely on his own perception to complete the uncompleted plans may lead the interpretation of design in quite a different way than required. Eventually this leads to initiate dissonances between the concerned professionals at job interface. The Designer considers the mentioned origin as very potential one for initiating dissonances between professionals, regardless on this particular project this particular problem was not encountered by professional but considering their previous experiences and observations the designer has ranked it as “very important”. (*Designer*)

Considering this particular project, the contractor didn't encounter this specific problem. The contractor has ranked this origin as important origin of dissonances. Because of the lack of sufficient knowledge of materials and equipment brings the designer at the verge of quite misleading design information. Eventually that initiates dissonances between the professionals. (*Contractor*)

9) Insufficient Working Drawing Details:

Insufficient working drawing details brings the contractor at the verge of vulnerable state if he pursues the project with insufficient drawing details it can lead him in the wrong way which might ends up as not the required one or delayed one. Insufficient working details originates quite a significant dissonance between the professional cause the designer would like to get the work done according to his best perception, whereas if he doesn't provide sufficient information on working drawings, the contractor would not be able to comprehend the actual sense of stipulated job. Eventually it is a potential origin of dissonances between the parties. The participants ranked this origin as important origin. Considering the particular project they didn't face this very problem but their selection on questionnaire is purely based on their previous experiences and observations.

(Designer, Contractor)

10) Insufficient Communication between the Contractor & Designer Dyad:

Communications gap is a potential dissonance origin, because lack of communication leads to misunderstanding of the required job and eventually ends up in adversely affecting the project. In case of communication gap there can be very severe results to the project progress. Usually there is quite sufficient communication between the professionals as conventional practice that prevails in construction industry. Therefore it is ranked as somewhat important origin for professional dissonances. *(Contractor)*

Communication is virtually the back bone of any professional dyad relationship to nurture the development of better opportunities and best outcome from present business. Ways to improve coordination and communication include coordination meetings, progress reports, and conference calls among others. Communication between the

contractor & designer is an important aspect to control and mitigate the severe professional dissonances, but if there are design consultant involved in the project then the schism between the designer and contractor can be overcome by the consultants. On this particular project, the designer doesn't phase any significant gap between communication channels across the professionals and that keeps the project progress on the right track. (*Designer*)

11) Lack of Mutual Respect between the Professionals:

Lack of mutual respect between the professionals is not an important origin of professional dissonances because regardless of any case of lack of mutual respect between the professionals doesn't affect the relationship on the design and construction interfaces. Eventually they have to fulfill their professional duties with their best input. Considering the particular project the contractor didn't encounter any such problem, based on the previous experience and the considering the particular project the contractor has ranked this origin as "not important" origin of dissonances. (*Contractor*)

Lack of mutual respect between the professionals is a social aspect which adversely affects the entire project. For better coordination during the project completion phases, mutual respect plays vital role because through mutual professional respect the participants regards each others decisions and opinions for betterment of entire project. In case of lack of mutual respect between the professionals, they don't usually agree on amicably on any issue regarding project development. Eventually this brings the professionals at the verge of professional mismanagement for pursuing the project in the stipulated direction for completion, unnecessary delays are very common in this scenario.

The Designer ranked this as an important origin for dissonances at professional interface. (*Designer*)

12) Exotic Design & Technology:

Exotic design and technology is an origin for potential dissonance, because it needs more attention from both parties as compare to local design and technology in which the participants has already experienced. Exotic design is one of the very potential origin of dissonances, because it is quite difficult to fulfill the basic essential requirements in proper way. Lack of coordination and communication and experience in case of exotic design and technology impacts the entire project in disastrous means and eventually affects the whole working environment and its consequences. The designer feels that it is one of the very important origins, therefore they considered this as high intensity origin. (*Designer*)

Exotic design and technology is not an important origin of dissonances because the designers and consultants are quite well known of the required expertise for catering the special need of design and technology. On this particular project, it is considered to be the one of his kind because of the design and the materials, which eventually shaping up the whole form of project. The Contractor encountered no difficulty in catering the design with other professionals on this particular project. (*Contractor*)

13) Ambiguous Design Details:

Considering the conventional professional practice that prevails in construction industry, the professionals consider that design ambiguity is a common scenario and it should be handled with care and extra explanation about the design details. Design ambiguity is an important origin of dissonances, on this particular project the designer

has faced the need for some extra elaboration of some information and details for better manifestation of the stipulated job. The origin is ranked as “somewhat important” on the questionnaire, because the contractor felt that the sense of ambiguity in design can be explained without delaying any job line on the continuing project phases. (*Contractor*)

It is an origin for potential dissonance because there is a possibility of misunderstanding the required work and eventually the work has to be done again and initiate delay in the entire cycle of project completion. Less ambiguity in design detail tends to have more comprehension on the right stipulated track for work done, eventually, it initiate a better work environment for entire professional team with less professional conflicts. On this specific project the participants encountered numerous phases where they were quite misled by the ambiguity of design. Therefore the origin is ranked as the very important by these professionals. (*Designer*)

14) Lack of Specialized Construction Manager:

The designer perceives that in the presence of construction manager the management of job lines are quite easy and possibility of any large scale error is quite eliminates. Considering the particular project, the designer didn't encounter this specific problem because the contractor had specialized construction manager on site to manage the on-going works at construction job site. Based on the previous experience, the designer has ranked this origin as “important” origin of dissonances. (*Designer*)

Construction manager, carries out the construction phase in an organized ways which eliminates the risk of delays and other problems which occurs if the work items are not carried out in organized manner. On this particular project the firms have the specialized construction managers who are quite capable of handling the projects and its

requirements most aptly. The contractor considers that in case of absence of any specialized construction manager the job can be handled without any hindrance, therefore the contractor has ranked it as “not important” origin of dissonances. (*Contractor*)

15) Material Changes during Construction Phase:

Considering the particular project, there were many stages where the materials were re-selected because of numerous reasons, the designer considers this origin as the “most important” origin of professional dissonances on design and construction interfaces. Material change in specifications and types is a very frequent activity observed in the construction of this particular project. During construction phase, the change in specifications and types eventually affects the chain of project completion because for better analysis of the new material require some time from professional for which the on going jobs have to be delayed. It is one of the major changes which contractor has to accommodate and also provide time to the designer to go through the design analysis according to the new material type and specifications. Material changes in types and specifications are the one which are based on the personal propensity to create change in overall design impact, therefore this origin is different from the shortage of material cases. (*Designer*)

The Contractor considers that material changes is a usual process during construction of project. These changes usually doesn't delay the project in adverse means, on this particular project there were many minor changes during the project completion. These changes were accommodated quite aptly and the professionals didn't let those changes hinder the pace of project. Considering the previous experience the contractor has ranked

this as “not important” origin of dissonances between professionals on design and construction interfaces. (*Contractor*)

16) Shortage of Construction Materials:

Occasionally the shortage of material tends to change the design to accommodate the new material as the replacement for the previous one on which the design is already been developed. It initiates dissonance between designer and contractor because eventually the participants blame the delay or compromise, which they have to accommodate, on each other. Considering the project the contractor didn't encounter such problem in severe conditions therefore it didn't affect the project adversely. The contractor ranked this origin as somewhat important origin of dissonances between professionals. (*Contractor*)

Considering the particular project the participants didn't face very problem, the designer has ranked this origin as one of the vital origins. Due to the shortage of material they have to accommodate and compromise for their design which eventually not the best and optimum outcome of their efforts. Shortage of construction material leads sometimes the design change or requires the professionals to review the design with new material which eventually be the replacement of the previously selected and studied one. It is purely a procurement problem, but it affects the entire chain of project completion phases. Occasionally the shortage of material tends to change the design to accommodate the new material as the replacement for the previous one on which the design is already been developed. It initiates dissonance between designer and contractor because eventually the participants blame the delay or compromise, which they have to accommodate, on each other. The concerned professional ranked this origin as very important origin for initiating dissonances on project interfaces. (*Designer*)

17) Design Errors:

The design errors are eventually the responsibility of the design development team, whose repercussions impacting the entire project usually in increase in cost to overcome those errors. The designer consider this as important origin of dissonances between professionals, because the other participant doesn't allow time to figure out the design errors and to rectify those incase of any occurrence. Considering the project the designer didn't encounter the problem. They have ranked it as important origin of dissonances.

(Designer)

The contractor has ranked the origin as "somewhat important" origin of dissonances between professionals on design and construction interfaces. Design errors which are not taken care of in the design development phase, eventually these errors occurs in construction phase and their impact is much more severe than in the design phase diagnosis. The design errors are eventually the responsibility of the design development team, whose repercussions impacting the entire project usually in increase in cost to overcome those errors. Designer is the one to be blamed for this hindrance in the development of project. Eventually the errors are faced and encountered by the contractor and it provides quite a hard time for contractor to accommodate and keep the pace of project unharmed. *(Contractor)*

18) Procurement Delays:

Considering the project the participants doesn't encountered any such problem but considering the conventional practice around the kingdom they have ranked this origin as important origin of dissonances between professionals. Procurement delays sometimes come up with the entire change or replacement for the actually stipulated materials or

equipments for the project. Procurement delay may have the tendency to bring the professional at the verge of rework for the project, as the required materials are not available then eventually the professional has to compromise based on the consent of all participants of projects. Eventually the participants blame others for the delay and demand that the procurement delays should be accommodated by the other professionals so that the actual delay can be reduced by any means. (*Contractor, Designer*)

19) Material Approvals:

Considering the project, the professionals didn't encounter such problem because of the sophisticated system which was practiced during various phases of project completion. Material approvals is an origin for potential dissonances as the process takes too long and the contractor has to interrupt the construction process to get approval of materials, eventually it leads to professional conflicts because each participants require to complete his part of project as soon as possible. Material approvals is an origin for potential dissonances, considering conventional practices in construction industry, it takes quite a long time for approval and eventually it hinders the project pace. The designer and contractor have ranked this origin as important origin. (*Designer, Contractor*)

20) Lack of Coordination between Dyad:

Lack of coordination between dyad initiates professional conflicts and eventually impacts the project adversely, as lack of coordination tends to augment the errors which usually can be resolved before they affect the project in any respect. Designer and contractor should have professional coordination between themselves, because through the project completion they have to work at different interfaces of project processes. On

this particular project this issue of dissonances was not particularly experienced by the concern professionals. Considering conventional practice that prevails in construction industry they have ranked this origin as important. (*Designer, Contractor*)

21) Errors during Field Construction:

Considering particular project, the participants have not encountered severe issues regarding this origin, minor problem were the part of routine work and handled accordingly on the site. The designer expects this dissonance to be occur quite often. They ranked the origin as very important origin of dissonances between professionals. Errors during field construction is quite a frequent problem prevails in conventional practice in construction industry. These errors includes various types having the range of human errors to weather and other unpredictable errors. It is an origin for potential dissonances, if the coordination between the participants is not professional, then the dissonances are quite influential with adverse consequences. The designer perceives that errors during construction process are usually covered by the contractor and they tend to hide the errors and blame that on designer. (*Designer*)

Errors during field construction are usually the consequences of design flaws, sometime the errors occurs due to some technical flaws during the construction on site. Errors during field construction is quite a frequent problem prevails in conventional practice in construction industry. These errors includes various types having the range of human errors to weather and other unpredictable errors. On this particular project, the contractor has not face any severe problem regarding this origin, they have ranked the origin as somewhat important origin based on the conventional practice in construction industry. (*Contractor*)

22) Lack of Specialized Human Resources:

Considering the project, the contractor had quite sufficient specialized human resource, therefore they didn't encounter this such problem. Lack of specialized human resources is an important origin of dissonances, it has the tendency to bring professionals at the verge of severe conflicts on design and construction interface. The Contractor ranked this origin as somewhat important, based on professional experience and conventional practices in construction industry. (*Contractor*)

Lack of specialized human resource brings the professionals at the verge of intense dissonances, on this particular project human resources are quite specialized in their field. The Designer ranked it as important origin of dissonances. Lack of skilled human resources is one of the major origins for potential dissonances, because in certain jobs may require certain expertise that is not available in the local market and for that reason the consultant may agree to modify the method or procedure of construction. This type of change is more likely to occur in construction involving some degree of technological complexity, whereas in conventional building projects there is not much intense need for specialized human resources. (*Designer*)

23) Designer's Lack of Awareness about ongoing Construction Process:

Lack of awareness about the on-going construction project, leads the designer and the contractor towards dissonances, because if any errors occur in construction site and if not reported to designer on time then the problem can turn out to be disastrous for entire project at the later stages of errors impacts. The contractor is convinced that in the presence of consultant which eventually managing the ongoing construction and they keep the track of activities therefore if the designer is not aware of on going

construction process it doesn't initiate any dissonance between the professionals working on project pace. It is ranked as somewhat important origin of dissonances between project participants. (*Contractor*)

Designer as the active participant of the entire project completion process, should be kept aware about the on-going construction process, it assists to overcome the problems in their initial stages with less severe impact on the entire project. On this particular project, designer doesn't encounter such dissonance during construction phase. They ranked it as an important origin of dissonance. (*Designer*)

24) Contractor's Lack of Comprehension of Drawing Details & Specs.:

Contractor's lack of comprehension in reading and interpreting the actual information from drawings and specifications, leads him to continue the project according to his wrong perception, eventually it initiate dissonance between the participants and impact the project adversely. Comprehension of drawing details and specifications is the basic key for any project to be interpreted in the stipulated way. Drawing details are the only means to comprehend the project, and before the inception of construction all the information from drawings should be interpreted to get complete comprehension. Considering the project, the contractor is quite capable of interpreting the actual information from drawings. Therefore they don't encounter this dissonance, and based on their experience the Designer ranked it as important origin. (*Designer*)

The Contractor on this particular project has not encountered such dissonance, and considering their previous experience on various other large projects, they have ranked it as somewhat important origin of dissonances which has the potential of bringing the professionals at the verge of some severe conflicts. (*Contractor*)

25) Involvement of Designer as Design Consultant:

In case of designer as design consultant, there is possibility that the designer would cover his faults and blame it to other participant. In this case, the owner is in vulnerable condition and cannot be safe from designer's errors and eventually the designer in this scenario can hide his flaws and blame it on other participants. Involvement of Designer as design consultant is an important origin for potential dissonances because if the designer as design consultant strive to overcome their design errors and blame those on the contractor, there is quite significant possibility for the contractor to face resistance in pointing out the design errors or ineffective design specifications. The Designer ranked it as very important origin. (*Designer*)

The contractor ranked this origin as somewhat important respectively, the professional considers it as initiator of dissonances because the designer can be bias on his particular job lines. The contractor consider it as somewhat important origin, because they conceive that if the designer himself is design consultant on the particular project is conventional practice in construction practice it doesn't bring the professional any severe conflicts. Specially on the particular project the designer was itself design consultant, and the relationship was not suffered any dissonances because of the bias nature on any issues of design to cover their own responsibilities. (*Contractor*)

26) Contractor's lack of Sufficient Knowledge:

Contemporary knowledge about new materials and equipment, is an influential factor in shaping up the entire project specifically during construction phase. Lack of present knowledge about available and new materials and equipments, affects the project adversely because the contractor is not aware of new technology therefore unable to

pursue for that project. Eventually, delaying project or occasionally ends up in vital changes in entire design entity, as it affects the chain of project completion therefore it initiate conflict between the concerned professional for not having the proper source of information and applicable details. The Designer ranked it as the important origin of dissonances, based on the experience in construction industry. (*Designer*)

The contractor on this particular project, didn't encountered such problem because they are quite aware of technology, usually the contractor are sufficient knowledge about new technology. Therefore the contractor ranked it as not important origin of dissonances between professionals on design and construction interfaces. (*Contractor*)

27) Design Complexity:

The designer considered the design complexity as an important origin of dissonances, because according to their previous experience it requires quite an aptness which eventually is not usually practiced in construction industry. Considering this particular project, design complexity was not of severe intensity, therefore it was quite aptly manifested by the concerned participants, and there were no need of extra explanations required by the contractor to carry out the job as expected. While considering the previous experience the designer convinced with idea of design complexity produce hard time for contractors to work on and to manifest the design as the designer would like to convey. (*Designer*)

Complexity of design requires skilled professionals to deal with it, as well as design complexity is difficult to handle as it is not in linear formats. Complexity also impacts the flow of construction activities as simple and linear construction works is easy to handle, complex design leads to loss of productivity, eventually it initiates dissonances between

the designers and contractors in handling the complex design. Design complexity is the factor which affects the project chain in the design as well as construction activities phases. The contractor has ranked this origin as somewhat important origin of dissonances between professionals, because they consider that while dealing with complex design, the participants have to flow the information in quite in-depth level. Which eventually brings the professional to some extent of conflict when one doesn't comprehend the design as in the real sense. (*Contractor*)

28) Buildability:

Buildability is the integration of various professional expertise, therefore it has the tendency to be generating interface where dissonances occurs between professionals. It is an origin for potential dissonances during both phases of construction and design in the entire chain of project completion. It is the integration of construction expertise into planning and design of a project so that the construction forces have the maximum opportunity to deliver the project in conformity with cost, quality, schedule and safety objectives of the project's stakeholders. The designer ranked it as important origin of dissonances because it is difficult job to bring various professional at one decisions amicably, each participant has its own opinion and they take quite a long time to convince each other on various aspects of project under buildability study. (*Designer*)

Buildability is the integration of construction expertise into planning and design of a project so that the construction forces have the maximum opportunity to deliver the project in conformity with cost, quality, schedule and safety objectives of the project's stakeholders. The contractor didn't practice it on this particular project, whereas considering the previous experience, they have ranked it as somewhat important origin.

They have the perception that the buildability is an effort which can be achieved by amalgamation of professionals on design and construction interfaces. That can be arranged quite conveniently and has the tendency of producing conflicts between professionals at quite a low level, usually the activity is completed quite amicably. (*Contractor*)

29) Building Codes:

Conventionally, the designers ensure that their design is in compliance with these codes. However, new regulations may be issued between design and construction and may force some changes to the original plan. Codes such as environmental codes are revised periodically and the designer and contractor are requested to accommodate those according to the need in the project. Usually in this case, the accommodation of various changes are quite difficult with participants as they carry out the work according to their own already worked out schedules and job plans. The Designer and contractor ranked it as somewhat important origin of dissonance for design and construction interface (*Designer, Contractor*)

30) Governmental Regulations:

Government regulations, is an influential factor of project, local authorities may have specific codes and regulations that must be accommodated in design and pursue in construction of project. In the conventional practice in construction industry the regulations don't modify or change so frequently and therefore the existing and prevailing regulations are completely followed and inculcate by the designer and contractor in their respective practices. The contractor ranked this origin as not important origin of dissonances between professionals. (*Contractor*)

Government regulations, as an influential factor of project, is an origin for potential dissonance, local authorities may have specific codes and regulations that must be accommodated in design and pursue in construction of project. Conventionally, the designers insure that their design is in compliance with these codes. However, new regulations may be issued between design and construction and may force some changes to the original plan. Codes such as environmental or labor codes are revised periodically and the designer and contractor are requested to comply. The designer ranked it somewhat important origin. (*Designer*)

31) Lack of Professional Experience & Judgment:

Lack of professional experience is one of the most influential origin for potential dissonances, because lack of experience leads the professional toward more liable to risk of errors on design as well as on the site activities. In case of lack of professional experience of one participant affects the jobs of other professional, eventually initiating dissonances between the concerned professionals. The designer consider this origin as the most important origin, because lack of professional experience leads the participants to the verge of misunderstanding about the stipulated job line. (*Designer*)

Considering the particular project, professionals were all experienced in the construction industry. All the participants are working in the construction industry for more than fifteen years and had taken many precious projects through out Saudi Arabia. The contractor is convinced about the professionals experience and judgment, because the large building projects were usually awarded to the professionals with sufficient project experience. Therefore the contractor has ranked this origin as not important origin of dissonances between professionals on design and construction interfaces. (*Contractor*)

32) Project Delivery System:

Project delivery systems have its own significance according to the basic philosophy of each delivery systems. For instance, lump sum type, contractor may pursue the project to save as much money as he could, and for that he may go for some compromise on quality and techniques to save money. Eventually, it initiates various dissonances between designer and contractor because of difference in goals. Considering the particular project the designer ranked the origin as very important origin, because of different perception of each participants according to the different types project delivery systems. (*Designer*)

The contractor consider this origin as not an important origin of dissonances, because they perceives that when the professionals accept any project under any specific delivery system, they fulfill the requirement of that system quite conveniently. There should be no dissonance initiating from this origin if the professional follows the standard format of that specific project delivery system. (*Contractor*)

33) Obstinate Nature of Participants:

Participants with obstinate nature would not accommodate each others even creative and beneficial ideas. Eventually, it initiates dissonances between the professional on project interfaces. Considering the particular project, the participants don't consider each other as obstinate in nature therefore they accommodate each other's opinion quite amicably. The designer ranked it as very important origin of dissonances on interface between professionals. (*Designer*)

The contractor ranked the origin as not important origin of dissonances. Considering the particular project, the professional didn't encounter any such rigidity of nature in

professional matters. The contractor mentioned that while on the design and construction interface, the professional usually don't be rigid because eventually they have to work together and amicably. (*Contractor*)

34) Honest Wrong Beliefs:

Honest wrong belief is one of the major hindrance for project pace. This occurs when contractor and designers, without having first hand knowledge, make decisions based on assumed user needs. Eventually, honest wrong belief is one of the major origin of potential dissonances between designer and contractor on project interfaces. Considering the particular project, the professionals didn't encounter any such problem, because the participants were quite well qualified about the technology and processes for project completion. The designer ranked it as somewhat important origin. (*Designer*)

Honest wrong belief of participants can be adversely affecting the project when the participants are of rigid nature and bound to their perceptions. Considering the particular project, the professionals didn't encounter any such problem, because the participants were quite well qualified about the technology and processes for project completion. The contractor ranked it as not important origin. (*Contractor*)

35) Economic Situation:

Economic situation of the entire country affects the construction processes and activities directly in the region. On the micro level of construction industry on a construction project if the economic condition of participants are not similar or somewhat sustainable then their goals would be varying accordingly, which eventually initiates conflict and discrepancies between participants on project interfaces. The designer and

contractor have ranked it as important origin of professional dissonances. (*Designer, Contractor*)

36) Fast Track Construction:

Fast track construction requires quite a sophisticated and organized system to carry out all the jobs which are interrelated with each other, it affects related activities if one activity delays it affect the other construction activity and the it goes on like snow ball phenomenon. Therefore it is an origin for dissonances between professionals. Considering the particular project, it isn't a fast track construction project. Therefore the professionals didn't have any chance to experience the particular approach and relevant dissonances. The designer ranked it as important origin, and contractor has ranked it as somewhat important origin of professional dissonances. (*Designer, Contractor*)

37) Weather Conditions:

Weather conditions impact on construction activities, has the tendency of initiating dissonances because when weather condition varies the contractor has to use some special precautions and on the designer's part those weather condition plays vital role in shaping up the entire design. If contractor is using a technique due to weather condition which was not worked out in the past, it finally initiates some minor conflict between them. The designer ranked this origin as somewhat important origin of dissonances between concerned participants. (*Designer*)

Weather conditions are the aspects which usually considered and well planned , before the construction activity begins. Therefore the contractor consider this origin as not important origin of dissonances between professional on design and construction

interfaces. On the particular project the professional didn't encounter any such problem relevant to weather conditions and its impacts on construction activities. (*Contractor*)

38) Nationality of Firms:

The professionals consider it as an important origin of dissonance because of the conventional practices in construction industry of kingdom, as most of the labor and other human resource is from various other countries and on various situations they face communication and practices gaps. Different nationality of participants has the tendency to be an origin of dissonances, because having different nationality would cause them communication problems and even problem in responding to various jobs in different ways as well as it affects the productivity of participants. The designer and contractor have ranked it as important origin of professional dissonances. (*Designer, Contractor*)

39) Change Orders:

All the concerned professionals on this particular project ranked this origin as important origin of dissonances, based on the previous project experience. There are various reasons for change order in construction project completion processes. It is an origin for potential dissonances because when ever a change order occur that would be settle down with some additional or less cost eventually affecting the goals of participants and project completion chains. (*Designer, Contractor*)

40) Preparation & Approval of Shop Drawing:

Preparation and approval of shop drawings is one of the most integral practice for carrying out the project activities as an organized and systematic way. This is an origin for dissonances because preparing of shop drawings need skilled people and approval of drawings require interactions between professionals, and if there is any delay in

approving those shop drawings from designer or require revising the drawings for long time causes dissonances between concerned participants. The designer ranked it as very important origin, and the contractor ranked it as somewhat important origin of dissonances between professionals. *(Designer, Contractor)*

41) Personal Conflicts between Professionals:

Better coordination during the project completion phases, with no personal conflicts, plays vital role because through mutual professional respect the participants regards each others decisions and opinions for betterment of entire project. It is an origin of dissonances between professional working on project interfaces. Personal conflicts between professionals causes them to act in the opposite way as much as possible, personal conflicts and disrespect between the professionals are social aspects which adversely affect the entire project. On this particular project, the professional didn't encounter any such problem prevailing in the professional environment. Therefore the contractor has ranked the origin based on the conventional practice, as they marked the origin as important origin of dissonance. The designer marked it as somewhat important origin of dissonances between professionals on design and construction interfaces. *(Designer, Contractor)*

42) Unforeseen Problem:

Unforeseen conditions is an issue which usually faced by the construction participants, if these conditions are not solved spontaneously may cause quite a major conflict between professionals. Considering the particular project, professional didn't face any such unforeseen problem, but the contractor considers it as important origin of dissonances based on the conventional practice of construction industry. . In case of

unforeseen problems if the participants are not ready to accommodate each others liabilities then it initiates dissonances between project professionals on interfaces. The designer considers it as somewhat important origin, based on their previous professional experiences. (*Designer, Contractor*)

43) Design Omission:

Design omissions require every professional to work over it and come up with new adjustment according to the new change in project design. It initiates dissonances between professionals depending on their perception and targets from projects. Change in design may occur when the design is reviewed by the designer. All the professionals ranked it as somewhat important origin of dissonance between professionals. Eventually it brings the professional on some conflicting grounds, that took some time to pacify those and reschedule the activities according to the new design requirements. (*Designer, Contractor*)

44) Involvement of Contractor as Consultant:

Involvement of contractor as consultant is the conventional professional practice in construction industry. The contractor perceives that if the contractor is assigned as consultant there won't be any severe dissonances based on that selection. On this particular project, where as the designer acted as consultant, considering the same scenario the contractor can be quite a well choice for being the consultant. There are some possibilities of dissonances based on the contractor being bias about his own responsibilities. The contractor has ranked it as somewhat important origin of professional dissonances. (*Contractor*)

Involvement of contractor as consultant is an origin for potential dissonances because if the contractors as consultant strive to overcome their construction errors and hide those errors or over cost the activities then keeping the project on the right track and getting the best out of that becomes very difficult. Eventually there is possibility for the designer to face resistance in rectifying the construction according to stipulated design and specifications. In case of contractor as consultant, there is possibility that the contractor would cover his faults and blame it to other participant. The designer ranked this origin as important origin of dissonances between the professionals. (*Designer*)

45) Project Construction Management As Individual Professional Service:

Project construction management as an individual service brings professionals at an amicable working environment which eventually lessen the dissonances between concerned participants. In this case there is minimum risk for professionals to blame other professional for any problem in project completion chains. The Contractor considered it as not an important origin because they feel that as an individual professional service it provides better opportunity for professional to work most neutral way. The contractor has ranked it as not important origin. (*Contractor*)

Project construction management as an individual professional service is a better way to accomplish a project with minimum dissonances between professionals. There are possibilities of causing project management professionals to spend considerable time to comprehend the project and its extents, before they plan out the management strategies for project completion. The Designer has ranked this origin as important origin of dissonances. (*Designer*)

46) The Conflict in the Scope of Work:

The contractor has additionally indicated an important origin of dissonances between professionals, that is the conflict in the scope of work. In this case the professionals have different scope of works and they perceive the scope according to their own manifestation, and also strive to lead the project in the same direction to achieve their scope of work. Eventually that initiates dissonances between the professionals.

(Contractor)

47) Additional costs for change orders:

The contractor has also indicated an important origin of dissonances between professionals, that is the additional costs for change orders. In this case the professionals tend to receive additional cost for any change orders, that might cause conflict between professionals because they blame the responsibilities of the change order to other participants on design and construction interfaces. The contractor considers it as an important origin of professional dissonances. *(Contractor)*

- **Al-Subeaei Commercial Center.**

Al-Subeaei center is a commercial high rise building, under construction, in Al-Khobar.

Following is the basic vital information regarding the project participants;

Project Owner: **M. & Abdullah Al-Subeaei.**

Project Designer: **Saudi Consolidated Engineering Company.**

Project Consultant: **Dar-ul-Riyadh Consultants.**

Project Contractor: **Swayeh Co.**

Project Profile:

The project is high rise building consist of fourteen floor of organization offices, purely a modern architectural design, based on the modernistic approach in architecture. It is an estimated over 20 million Saudi riyals project, located in Al-Khobar. There are three main professional bodies involved in the project, the Designer, the Contractor and the Design Consultant.

Project Questionnaire:

Questionnaire is considered as the base line for gathering information and analyzing the actual scenario. Each dissonance was discussed with the professional individually and the questionnaires were filled by the concern professionals.

Following are the Personnel responded from each participating parties in shaping up the project.

Designer	-----	<i>Senior Consultant Architect.</i>
Consultant	-----	<i>Project Engineer.</i>
Contractor	-----	<i>Construction Manager.</i>

Designer Firm Profile:

The designer firm “*Saudi Consolidated Eng. Company*” is a Saudi origin firm which has been working in the Kingdom for last fifteen years, the main office is in the area of Al-Khobar. It is a Saudi national firm which has worked on various private sector projects. The firm has completed mostly general building projects besides that it has worked on some industrial projects as well. The firm has extensive experience in design consultation.

Contractor Firm Profile:

The Contractor firm “*Swayeh Company*” is a grade 01 contractor, which has been working in the Kingdom for last fifteen years, the main office is in the area of Al-Riyadh. It is a Saudi national firm which has worked on various private sector projects and Government projects. The firm has completed mostly general building projects besides that it has worked on some industrial and Heavy civil projects as well, and most of the project were carried out under the Unit Cost contract type. The firm has extensive experience in project consultation.

Construction Management Firm Profile:

The construction management firm on this particular project is basically a Designer firm, which got the responsibility of construction management of the project. The firm is “*Dar-Al Riyadh*” is a designer and design consultant firm. It has been working in Saudi Arabian construction industry for last fifteen years. The nerve center of the firm is in the area of Al-Khobar. It is a joint venture firm which has worked on various government semi government projects as well as private sector projects. The firm has completed

mostly general building projects besides that it has worked on some industrial projects as well, and most of the project were carried out under the fixed lump sum contract type.

Following is the detailed expression about each dissonance as responded by the professionals.

1) Involvement of Contractor in Design Conceptual phase:

Involvement of contractor in design conceptual phase doesn't initiate significant dissonance, because involving contractor assists the designer in developing the most pragmatic design at the conceptual stages. Contractor with cooperative and accommodating nature is a positive addition towards the project development. (*Designer, Consultant*)

Involvement of contractor in design conceptual phase initiate dissonances very significantly, because designers are not accommodating in this respect. Any advise or proposal from contractor, face vigorous opposition from designer with preconceived ideas and notions that contractor is acting always at the opposite direction. Considering that the involvement of contractor may cause quite a negative impact on design professionals team, whereas the contribution of contractor can be of very useful for developing the design at the conceptual phase, but usually the involvement causes very strong negative impression on participants relationships. (*Contractor*)

2) Involvement of Contractor in Design Development Phase:

Involvement of contractor in design development phase doesn't initiate significant dissonance as involving contractor in conceptual phase, because involving contractor assists the designer in developing the most pragmatic design at the conceptual stages.

Contractor with cooperative and accommodating nature is a positive addition towards the project development. (*Designer, Consultant*)

Involvement of contractor in design development phase initiate dissonances very significantly as in conceptual phase, because designers are not accommodating in this respect. Any advise or proposal from contractor, face vigorous opposition from designer with preconceived ideas and notions that contractor is acting always at the opposite direction. Considering that the involvement of contractor may cause quite a negative impact on design professionals team, whereas the contribution of contractor can be of very useful for developing the design at the conceptual and development phase, but usually the involvement causes very strong negative impression on participants relationships. (*Contractor*)

3) Lack of Stipulated Data:

Lack of stipulated data is one of strong base for initiating dissonances between designer and contractor. Because in absence of stipulated data the participants specially contractor can misunderstood the required job and carry out in the direction opposite to the required one. Lack of stipulated data cannot assist in explaining the design sufficiently. Eventually designer blames the consequences lack of data on contractor and vice versa. Usually the target of lack stipulated data, is the contractor because they are subjected to vulnerable misunderstanding about project demands, therefore the designer and consultant opt for this particular origin of dissonance as the highest ranking . (*Designer, Consultant*)

Lack of stipulated data is one of the important origin for dissonance, because in this case the contractor is in most difficult situation because he is bound to refer to designer

again and verify about each missing information about design, eventually that takes a lot of his professional time as well as it also impact the pace of on going work. Ultimately, when contractor ask for compensation for his delay which eventually is the outcome of the lack of information provided by designer initiates serious dissonances between the professionals. The contractor opt for this particular origin as the second highest ranking in questionnaire. (*Contractor*)

4) Delay in Construction Documents Preparation:

Construction documents preparation is not an important and intense origin for professional dissonances between designer and contractor, because according to designer delay in construction documents preparations can be compensate quite easily and contractor face less problem in coop with this delay, eventually the time is overlapped with other activities supporting the construction phases. Usually the documents are prepared according to the schedule, whereas if not prepared, many basic details regarding the construction requirements are given to the contractor. On this particular project the designer doesn't face any problem of delay in construction documents preparation. (*Designer*)

Construction documents preparation is the major base for any project commencement of work and other processes to accomplish the project according to desired time frame. Any delay in the documents preparation, brings the professionals at the verge of conflict because the delay affects the preparation of preparatory works and planning. On this particular project the consultant has not encountered any severe delay in documents preparation and eventually it lead the professionals to accommodate their plans

accordingly and conveniently. Overall it is an important origin initiating severe professional dissonances between the designer and contractor. (*Consultant*)

Delay in construction documents preparation is an important origin of dissonances between professionals, most of the time the after effects of the delay is encountered by the contractor. The delay brings contractor at the verge of various intense hurdle which eventually ends up in affecting other activities' schedule and progress. The delay is solely the responsibility of designer, which eventually be faced by the contractor in various forms for instance, as in the absence if sufficient information to plan in anticipation for better control on project. (*Contractor*)

5) Lack of Human Resources for Design Firm:

Lack of human resources for design firm is a very potential origin for initiating dissonances, because lack of human resources bounds the design firm to compromise on various aspects of project design. Eventually it produces project design with various and numerous flaws. The flaws are the basic dissonances between the professionals because they have to rectify those and then proceed their work accordingly. Lack of human resources also bound the firm to produce the design at stipulated time frame and eventually it affects the chain of activities which are dependant on the requirement of stipulated comprehensive deign of project. Therefore all the concern participants on this particular project rank this origin as the highest intensity on questionnaire. (*Designer, Consultant & Contractor*)

6) Time Limitation in Design Phase:

Time limitation in design phase is a potential origin of dissonances between professionals. This particular project, as it is a large building project, professionals

encountered severe problem with the design time limitation, as the designer was bit delayed to complete the stipulated design with in the time constraint and eventually that affects the activities of the professional waiting for design to work on. Therefore all the concern participants on this particular project rank this origin as the highest intensity on questionnaire. (*Designer, Consultant & Contractor*)

7) Lack Of Designer Knowledge Of Available Materials & Equipments:

Lack of present knowledge about available materials and equipments, affects the project adversely where the specifications about design are not available then the whole process of defining specifications has to be repeated. Eventually, delaying project or occasionally ends up in vital changes in entire design entity, as it affects the chain of project completion therefore it initiate conflict between the concerned professional for not having the proper source of information and applicable details.

If the contractor calls for certain materials or work procedures, then a change order is required to substitute these materials or procedures. Specially in the Saudi environment, where material standardization is not common and where the market is full of all kinds of materials, making a pre-selection of materials is quite difficult. The concerned participants rank this potential origin of dissonances as “very important” on given questionnaire. (*Designer, Consultant & Contractor*)

8) Incomplete & Inadequate Plans and Specifications:

Incomplete and inadequate plans & specifications are not much helpful in defining the actual extents of design, as from the insufficient plans the contractor can not interpret information in the actual required forms. Sometimes the contractor has to approach the designer for verifications or further explanation about the design which is not given or

clarified on the plans and specifications, which eventually takes his professional time and efforts. If the contractor rely on his own perception to complete the uncompleted plans may lead the interpretation of design in quite a different way than required. Eventually this leads to initiate dissonances between the concerned professionals at job interface. The concerned participants consider the mentioned origin as very potential one for initiating dissonances between professionals, regardless on this particular project this particular problem was not encountered by professional but considering their previous experiences and observations they have ranked it as “very important”. (*Designer, Consultant & Contractor*)

9) Insufficient Working Drawing Details:

Insufficient working drawing details brings the contractor at the verge of vulnerable state if he pursues the project with insufficient drawing details it can lead him in the wrong way which might ends up as not the required one or delayed one. Insufficient working details originates quite a significant dissonance between the professional cause the designer would like to get the work done according to his best perception, whereas if he doesn't provide sufficient information on working drawings, the contractor would not be able to comprehend the actual sense of stipulated job. Eventually it is a potential origin of dissonances between the parties. The participants ranked this origin as the most important one on the questionnaire, on the particular project they didn't face this very problem but their selection on questionnaire is purely based on their previous experiences and observations. (*Designer, Consultant & Contractor*)

10) Insufficient Communication between the Contractor & Designer Dyad:

Communication between the contractor & designer is an important aspect to control and mitigate the severe professional dissonances, but if there are design consultant involved in the project then the schism between the designer and contractor can be overcome by the consultants. On this particular project, the designer doesn't phase any significant gap between communication channels across the professionals and that keeps the project progress on the right track. (*Designer*)

Communication is virtually the back bone of any professional dyad relationship to nurture the development of better opportunities and best outcome from present business. Ways to improve coordination and communication include coordination meetings, progress reports, and conference calls among others. Communications gap is a potential dissonance origin, because lack of communication leads to misunderstanding of the required job and eventually ends up in adversely affecting the project. In case of communication gap there can be very severe results to the project progress, there it is ranked as very important origin for professional dissonances. (*Consultant, Contractor*)

11) Lack of Mutual Respect between the Professionals:

Lack of mutual respect between the professionals is a social aspect which adversely affects the entire project. For better coordination during the project completion phases, mutual respect plays vital role because through mutual professional respect the participants regards each others decisions and opinions for betterment of entire project. In case of lack of mutual respect between the professionals, they don't usually agree on amicably on any issue regarding project development. Eventually this brings the professionals at the verge of professional mismanagement for pursuing the project in the

stipulated direction for completion, unnecessary delays are very common in this scenario. The professionals ranked this as the most important origin for dissonances at professional interface. (*Designer, Consultant & Contractor*)

12) Exotic Design & Technology:

Exotic design and technology is not an important origin of dissonances because the designers and consultants are quite well known of the required expertise for catering the special need of design and technology. On this particular project, it is considered to be the one of his kind because of the design and the materials, which eventually shaping up the whole form of project. The designer and consultant encountered no difficulty in catering the design with other professionals on this particular project. (*Designer, Consultant*).

Exotic design is one of the very potential origin of dissonances, because it is quite difficult to fulfill the basic essential requirements in proper way. Exotic design and technology is an origin for potential dissonance, because it needs more attention from both parties as compare to local design and technology in which the participants has already experienced. Lack of coordination and communication and experience in case of exotic design and technology impacts the entire project in disastrous means and eventually affects the whole working environment and its consequences. The contractor feels that it is one of the very important origins, therefore they considered this as high intensity origin. On this particular project the contractor felt that the designer and consultant was not satisfactorily catered the complete information, because of the exotic nature of project as well as the rather new technology, for materials joints in the whole design. (*Contractor*)

13) Ambiguous Design Details:

The participants of the project faces numerous misunderstandings while the design contains ambiguous details about any aspects of design. Ambiguity in design has the tendency to lead the participants' perception away from the stipulated one. It is an origin for potential dissonance because there is a possibility of misunderstanding the required work and eventually the work has to be done again and initiate delay in the entire cycle of project completion. Less ambiguity in design detail tends to have more comprehension on the right stipulated track for work done, eventually, it initiate a better work environment for entire professional team with less professional conflicts. On this specific project the participants encountered numerous phases where they were quite misled by the ambiguity of design. Therefore the origin is ranked as the very important by these professionals. (*Consultants, Contractor*)

Design ambiguity is an important origin of dissonances, on this particular project the designer has faced the need for some extra elaboration of some information and details for better manifestation of the stipulated job. The origin is ranked as important on the questionnaire, because the designer felt that the sense of ambiguity in design can be explained without delaying any job line on the continuing project phases. (*Designer*)

14) Lack of Specialized Construction Manager:

Specialized construction manager is the need of time and project, as the new technology emerges into the construction industry, the need of specialized professional becomes more intense with the development of technology. In the absence of specialized construction manager, the concerned jobs are in the hands of nonprofessionals which eventually threaten the proper completion of project as stipulated ways. Construction

manager, carries out the construction phase in an organized ways which eliminates the risk of delays and other problems which occurs if the work items are not carried out in organized manner. On this particular project the firms have the specialized construction managers who are quite capable of handling the projects and its requirements most aptly. Where as in the absence of these professionals this can be a potential origin of dissonances between the concerned parties of project. (*Contractor, Consultant*)

The designer ranked this origin of dissonances as an important origin, beside that they perceive that in the presence of construction manager the management of job lines are quite easy and possibility of any large scale error is quite eliminates. (*Designer*)

15) Material Changes during Construction Phase:

Material change in specifications and types is a very frequent activity observed in the construction of this particular project. During construction phase, the change in specifications and types eventually affects the chain of project completion because for better analysis of the new material require some time from professional for which the on going jobs have to be delayed. It is an origin of potential dissonance , because it is one of the major changes which contractor has to accommodate and also provide time to the designer to go through the design analysis according to the new material type and specifications. Material changes in types and specifications are the one which are based on the personal propensity to create change in overall design impact, therefore this origin is different from the shortage of material cases. On this particular project the façade finishes was thrice changed and eventually each time it hinders the construction activity which awaits to get the approvals. (*Designer, Contractor*)

The consultant faces quite a tough time in managing the information and its requirement to implement the changed specifications, they feel that it is a very important origin of professional dissonances between the parties because they blame other for coming up with the new suggestion of specifications and types. (*Consultant*)

16) Shortage of Construction Materials:

Shortage of construction material leads sometimes the design change or requires the professionals to review the design with new material which eventually be the replacement of the previously selected and studied one. It is purely a procurement problem, but it affects the entire chain of project completion phases. Occasionally the shortage of material tends to change the design to accommodate the new material as the replacement for the previous one on which the design is already been developed. It initiates dissonance between designer and contractor because eventually the participants blame the delay or compromise, which they have to accommodate, on each other. On this particular project the participants didn't face very problem, but they ranked this origin as one of the vital ones because the designer perceives that due to the shortage of material they have to accommodate and compromise for their design which eventually not the best and optimum outcome of their efforts. Contractor faces quite difficult in rescheduling the activities and the human resources according to the availability of construction materials. The concerned professionals ranked this origin as an important origin for initiating dissonances on project interfaces. (*Designer, Contractor & Consultant*)

17) Design Errors:

Design errors which are not taken care of in the design development phase, eventually these errors occurs in construction phase and their impact is much more severe than in the

design phase diagnosis. The design errors are eventually the responsibility of the design development team, whose repercussions impacting the entire project usually increase in cost to overcome those errors. Designer is the one to be blamed for this hindrance in the development of project. Eventually the errors are faced and encountered by the contractor and it provides quite a hard time for contractor to accommodate and keep the pace of project unharmed. The professionals agree on that “later the diagnosis of design error more severe is the effects on the progress of all the participants”. (*Contractor, Consultant*)

The designer ranked this origin as the “important” but not the most important because as to the perception of designer they claim that these errors are usually catered in the early stages and doesn’t affect very severely. (*Designer*)

18) Procurement Delays:

Procurement delays sometimes come up with the entire change or replacement for the actually stipulated materials or equipments for the project. Procurement delay may have the tendency to bring the professional at the verge of rework for the project, as the required materials are not available then eventually the professional has to compromise based on the consent of all participants of projects. On this particular project the participants doesn’t encountered any such problem but considering the conventional practice around the kingdom they have ranked this origin as the very important origin of dissonances between professionals, eventually the participants blame others for the delay and demand that the procurement delays should be accommodated by the other professionals so that the actual delay can be reduced by any means. (*Contractor, Consultant*)

Procurement delays is one of the origin of potential dissonances, because procurement delay has various serious after effects on the other dependant processes of construction in the entire chain of project completion. The designer ranked the origin as important on the given Performa. (*Designer*)

19) Material Approvals:

Material approvals is an origin for potential dissonances as the process takes too long and the contractor has to interrupt the construction process to get approval of materials, eventually it leads to professional conflicts because each participants require to complete his part of project as soon as possible. On this particular project contractor encountered some severe difficulties during the approval process, specially during the façade finish materials. Therefore they ranked it as very important origin. (*Contractor, Consultant*)

Material approvals is an origin for potential dissonances, considering conventional practices in construction industry, it takes quite a long time for approval and eventually it hinders the project pace. On this particular project this problem was not experienced because of the sophisticated system which was practiced during various phases of project completion. The designer has ranked this origin as important one rather than very important. (*Designer*)

20) Lack of Coordination between Dyad:

Designer and contractor should have professional coordination between themselves, because through the project completion they have to work at different interfaces of project processes. Lack of coordination between dyad initiates professional conflicts and eventually impacts the project adversely, as lack of coordination tends to augment the errors which usually can be resolved before they affect the project in any respect. On this

particular project this issue of dissonances was not particularly experienced by the concern professionals. Considering conventional practice that prevails in construction industry they have ranked this origin as very important. (*Designer, Consultant& Contractor*)

21) Errors during Field Construction:

Errors during field construction is quite a frequent problem prevails in conventional practice in construction industry. These errors includes various types having the range of human errors to weather and other unpredictable errors. It is an origin for potential dissonances, if the coordination between the participants is not professional, then the dissonances are quite influential with adverse consequences. The designer and consultant perceive that errors during construction process are usually covered by the contractor and they tend to hide the errors and blame that on designer. On this particular project, the participants have not faced such problem for the moment but they have mentioned that they expect this dissonance to be occur quite often. They ranked the origin as an important origin of dissonances between professionals. (*Designer, Consultant*)

Errors during field construction are usually the consequences of design flaws, sometime the errors occurs due to some technical flaws during the construction on site. On this particular project, the contractor has not face any severe problem regarding this origin, they have ranked the origin as the most important origin based on the conventional practice in construction industry. (*Contractor*)

22) Lack of Specialized Human Resources:

Lack of skilled human resources is one of the major origins for potential dissonances, because in certain jobs may require certain expertise that is not available in the local

market and for that reason the consultant may agree to modify the method or procedure of construction. This type of change is more likely to occur in construction involving some degree of technological complexity, whereas in conventional building projects there is not much intense need for specialized human resources. Lack of specialized human resource brings the professionals at the verge of intense dissonances, on this particular project human resources are quite specialized in their field. The contractor ranked it as very important origin of dissonances. (*Contractor*)

Lack of specialized human resources is an important origin of dissonances, it has the tendency to bring professionals at the verge of severe conflicts on design and construction interface. The designer and consultant ranked this origin as important, based on professional experience and conventional practices in construction industry. (*Designer, Consultant*)

23) Designer's Lack of Awareness about ongoing Construction Process:

The consultant ranked it as not important origin because they are convinced that in the presence of consultant which eventually managing the ongoing construction and they keep the track of activities therefore if the designer is not aware of on going construction process it doesn't initiate any dissonance between the professionals working on project pace. (*Consultant*)

Designer as the active participant of the entire project completion process, should be kept aware about the on-going construction process, it assists to overcome the problems in their initial stages with less severe impact on the entire project. On this particular project, designer doesn't encounter such dissonance during construction phase. They ranked it as an important origin of dissonance. (*Designer*)

Lack of awareness about the on-going construction project, leads the designer and the contractor towards dissonances, because if any errors occur in construction site and if not reported to designer on time then the problem can turn out to be disastrous for entire project at the later stages of errors impacts. It is ranked as very important origin of dissonances between project participants. (*Contractor*)

24) Contractor's Lack of Comprehension of Drawing Details & Specs.:

Comprehension of drawing details and specifications is the basic key for any project to be interpreted in the stipulated way. Drawing details are the only means to comprehend the project, and before the inception of construction all the information from drawings should be interpreted to get complete comprehension. Contractor's lack of comprehension in reading and interpreting the actual information from drawings and specifications, leads him to continue the project according to his wrong perception, eventually it initiate dissonance between the participants and impact the project adversely. On the project, the contractor is quite capable of interpreting the actual information from drawings. Therefore they don't encounter this dissonance, and based on their experience the contractor and consultant ranked it as very important origin. (*Contractor, Consultant*)

The designer on this particular project has not faced such dissonance, and considering their previous experience on various other large projects, they have ranked it as important origin of dissonances which has the potential of bringing the professionals at the verge of severe conflicts. (*Designer*)

25) Involvement of Designer as Design Consultant:

Involvement of Designer as design consultant is an important origin for potential dissonances because if the designer as design consultant strive to overcome their design errors and blame those on the contractor, there is quite significant possibility for the contractor to face resistance in pointing out the design errors or ineffective design specifications. In case of designer as design consultant, there is possibility that the designer would cover his faults and blame it to other participant. In this case, the owner is in vulnerable condition and cannot be safe from designer's errors and eventually the designer in this scenario can hide his flaws and blame it on other participants. The consultant ranked it as very important origin. (*Consultant*)

The designer and the contractor ranked this origin as important and somewhat important respectively, the designer consider it as initiator of dissonances because the designer can be bias on his particular job lines. The contractor consider it as not very important origin, because they conceive that if the designer himself is design consultant on the particular project is conventional practice in construction practice it doesn't bring the professional any severe conflicts. (*Designer, Contractor*)

26) Contractor's lack of Sufficient Knowledge:

Considering the previous professional experience, the designer and consultant ranked this origin as important origin of dissonances between professionals. Contemporary knowledge about new materials and equipment, is an influential factor in shaping up the entire project specifically during construction phase. Lack of present knowledge about available and new materials and equipments, affects the project adversely because the contractor is not aware of new technology therefore unable to pursue for that project.

Eventually, delaying project or occasionally ends up in vital changes in entire design entity, as it affects the chain of project completion therefore it initiate conflict between the concerned professional for not having the proper source of information and applicable details. The contractor ranked it as the most important origin of dissonances, based on the experience in construction industry. (*Designer, Consultant & Contractor*)

27) Design Complexity:

Complexity of design requires skilled professionals to deal with it, as well as design complexity is difficult to handle as it is not in linear formats. Complexity also impacts the flow of construction activities as simple and linear construction works is easy to handle, complex design leads to loss of productivity, eventually it initiates dissonances between the designers and contractors in handling the complex design. Design complexity is the factor which affects the project chain in the design as well as construction activities phases. The contractor and consultant ranked this origin as an important origin but not as very important one because they feel that usually the contractors and consultants are equipped to handle the design complexity quite aptly. Whereas the designer considered the design complexity as one of the very important origin of dissonances, because according to their previous experience it requires quite an aptness which eventually is not usually practiced in construction industry. Considering this particular project, design complexity was not of very severe intensity, therefore it was quite aptly manifested by the concerned participants, even though there were some phase where some extra explanations were required by the contractor to carry out the job as expected. It is the origin which has the tendency of producing severe consequences in the form of rather

incapability to handle the job in right direction as well as misinterpretation of the stipulated design. (*Contractor, Consultant & Designer*)

28) Buildability:

On this particular project there were quite a few attempts to achieve the building concept at very initial stages of project development. Buildability is the integration of construction expertise into planning and design of a project so that the construction forces have the maximum opportunity to deliver the project in conformity with cost, quality, schedule and safety objectives of the project's stakeholders. As it is the integration of various professional expertise, therefore it has the tendency to be generating interface where dissonances occurs between professionals. It is an origin for potential dissonances during both phases of construction and design in the entire chain of project completion. The designer and contractor ranked it as very important origin of dissonances because it is very difficult job to bring various professional at one decisions amicably, each participant has its own opinion and they take quite a long time to convince each other on various aspects of project under buildability study. The consultant ranked the origin as important origin of dissonances. (*Designer, Contractor & Consultant*)

29) Building Codes:

The Designer and contractor ranked it as very important origin of dissonance for design and construction interface. Conventionally, the designers insure that their design is in compliance with these codes. However, new regulations may be issued between design and construction and may force some changes to the original plan. Codes such as environmental codes are revised periodically and the designer and contractor are requested to accommodate those according to the need in the project. Usually in this case,

the accommodation of various changes are quite difficult with participants as they carry out the work according to their own already worked out schedules and job plans. The consultant ranked it as important origin on the given questionnaire. (*Designer, Contractor & Consultants*)

30) Governmental Regulations:

Government regulations, as an influential factor of project, is an origin for potential dissonance, local authorities may have specific codes and regulations that must be accommodated in design and pursue in construction of project. Conventionally, the designers insure that their design is in compliance with these codes. However, new regulations may be issued between design and construction and may force some changes to the original plan. Codes such as environmental or labor codes are revised periodically and the designer and contractor are requested to comply. The designer and contractor ranked it as very important origin, whereas consultant ranked it as important origin. (*Designer, Contractor & Consultant*)

31) Lack of Professional Experience & Judgment:

Previous experience assists the designer and contractor to resolve obstacles in project completion. Lack of professional experience is one of the most influential origin for potential dissonances, because lack of experience leads the professional toward more liable to risk of errors on design as well as on the site activities. Incase of lack of professional experience of one participant affects the jobs of other professional, eventually initiating dissonances between the concerned professionals. The designer consider this origin as the most important origin, because lack of professional experience leads the participants to the verge of misunderstanding about the stipulated job line. The

consultant considers this origin as important one and contractor ranked it as somewhat important origin. (*Designer, Contractor & Consultant*)

32) Project Delivery System:

Project delivery systems have its own significance according to the basic philosophy of each delivery systems. For instance, lump sum type, contractor may pursue the project to save as much money as he could, and for that he may go for some compromise on quality and techniques to save money. Eventually, it initiates various dissonances between designer and contractor because of difference in goals. Considering the particular project the designer and consultant ranked the origin as important, and the contractor ranked it as most important origin, because of different perception of each participants according to the different types project delivery systems. (*Designer, Consultant & Contractor*)

33) Obstinate Nature of Participants:

Obstinate nature of participants is one of the most expressed origin of dissonances, which is considered to be the one hindering the progress of any project with severe consequences. . If participants are of obstinate nature then they would not accommodate each others even creative and beneficial ideas. Eventually, it initiates dissonances between the professional on project interfaces. Considering the particular project, the participants don't consider each other as obstinate in nature therefore they accommodate each other's opinion quite amicably. The designer and consultant ranked it as important origin and the contractor ranked it as most important origin of dissonances on interface between professionals. (*Designer, Consultant & Contractor*)

34) Honest Wrong Beliefs:

Honest wrong belief is one of the major hindrance for project pace. This occurs when contractor and designers, without having first hand knowledge, make decisions based on assumed user needs. Eventually, honest wrong belief is one of the major origin of potential dissonances between designer and contractor on project interfaces. Considering the particular project, the consultant has encountered a mentionable incident regarding the horde slab and the placement of blocks, initially the contractor has placed the blocks in the wrong direction, and was not ready to be convinced about rectifying the mistake because they were quite rigid with their beliefs of conventional practice. Eventually it took a lot of time from professionals to bring him at convincible state and finally after that stage the contractor rectified the placement of blocks on the proceeding floors of project. The designer and consultant have ranked it as important origin, and contractor has ranked it as most important origin of professional dissonances. (*Designer, Consultant & Contractor*)

35) Economic Situation:

Economic situation of the entire country affects the construction processes and activities directly in the region. On the micro level of construction industry on a construction project if the economic condition of participants are not similar or somewhat sustainable then their goals would be varying accordingly, which eventually initiates conflict and discrepancies between participants on project interfaces. The designer and consultant have ranked it as important origin, and contractor has ranked it as most important origin of professional dissonances. (*Designer, Consultant & Contractor*)

36) Fast Track Construction:

Considering the particular project, it isn't a fast track construction project. Therefore the professionals didn't have any chance to experience the particular approach and relevant dissonances. It requires quite a sophisticated and organized system to carry out all the jobs which are interrelated with each other, it affects related activities if one activity delays it affect the other construction activity and the it goes on like snow ball phenomenon. Therefore it is an origin for dissonances between professionals. The designer and consultant have ranked it as important origin, and contractor has ranked it as most important origin of professional dissonances. (*Designer, Consultant & Contractor*)

37) Weather Conditions:

Different weather conditions have different requirements to be considered by the professionals, and they have to accommodate the special considerations to carry out their jobs according to the stipulated schedule and techniques. It has the tendency of initiating dissonances because when weather condition varies the contractor has to use some special precautions and on the designer's part those weather condition plays vital role in shaping up the entire design. If contractor is using a technique due to weather condition which was not worked out in the past, it finally initiates some minor conflict between them. All the professionals on this particular project ranked this origin as important origin of dissonances between concerned participants. (*Designer, Consultant & Contractor*)

38) Nationality of Firms:

Different nationality of participants has the tendency to be an origin or dissonances, because having different nationality would cause them communication problems and even problem in responding to various jobs in different ways as well as it affects the

productivity of participants. The professionals on this project don't consider it as an important origin of dissonance because of the conventional practices in construction industry of kingdom, as most of the labor and other human resource is from various other countries. The human resources with different nationality, are working as amicably and aptly as in case of same nationality human resources. The designer and contractor have ranked it as somewhat important and consultant has ranked it as not important origin of professional dissonances. (*Designer, Consultant & Contractor*)

39) Change Orders:

There are various reasons for change order in construction project completion processes. It is an origin for potential dissonances because when ever a change order occur that would be settle down with some additional or less cost eventually affecting the goals of participants and project completion chains. All the concerned professionals on this particular project ranked this origin as important origin of dissonances, based on the project experience. (*Designer, Consultant & Contractor*)

40) Preparation & Approval of Shop Drawing:

The concerned professionals on this particular project, encountered various problem regarding shop drawings. They have ranked this origin as important origin of dissonances. Preparation and approval of shop drawings is one of the most integral practice for carrying out the project activities as an organized and systematic way. This is an origin for dissonances because preparing of shop drawings need skilled people and approval of drawings require interactions between professionals, and if there is any delay in approving those shop drawings from designer or require revising the drawings for

long time causes dissonances between concerned participants. (*Designer, Consultant & Contractor*)

41) Personal Conflicts between Professionals:

Personal conflicts between professionals causes them to act in the opposite way as much as possible, personal conflicts and disrespect between the professionals are social aspects which adversely affect the entire project. For better coordination during the project completion phases, mutual respect, with no personal conflicts, plays vital role because through mutual professional respect the participants regards each others decisions and opinions for betterment of entire project. It is an origin for dissonances between professional working on project interfaces. On this particular project, the professional don't have any such problem prevailing in the professional environment. Therefore they have ranked the origin based on the conventional practice, as they marked the origin as important origin of dissonance in conventional practice. (*Designer, Consultant & Contractor*)

42) Unforeseen Problem:

Considering the particular project, professional didn't face any such unforeseen problem, but they ranked the origin as important origin of dissonances based on the conventional practice of construction industry. Unforeseen conditions is an issue which usually faced by the construction participants, if these conditions are not solved spontaneously may cause quite a major conflict between professionals. In case of unforeseen problems if the participants are not ready to accommodate each others liabilities then it initiates dissonances between project professionals on interfaces. (*Designer, Consultant & Contractor*)

43) Design Omission:

Change in design may occur when the design is reviewed by the designer. Design omissions require every professional to work over it and come up with new adjustment according to the new change in project design. It initiates dissonances between professionals depending on their perception and targets from projects. All the professionals ranked it as important origin of dissonance between professionals, considering the particular project the professionals encountered design omission on a few points of design. Which eventually it brings the professional on some conflict grounds, that took some time to pacify those and reschedule the activities according to the new design requirements. (*Designer, Consultant & Contractor*)

44) Involvement of Contractor as Consultant:

The consultant ranked this origin as the not important origin because they feel that if the contractor is assigned as consultant, there is no harm in this option and it is carried out in construction industry as conventional practice. Involvement of contractor as consultant is an origin for potential dissonances because if the contractors as consultant strive to overcome their construction errors and hide those errors or over cost the activities then keeping the project on the right track and getting the best out of that becomes very difficult. Eventually there is possibility for the designer to face resistance in rectifying the construction according to stipulated design and specifications. In case of contractor as consultant, there is possibility that the contractor would cover his faults and blame it to other participant. The designer and contractor ranked this origin as important origin of dissonances between the professionals. (*Designer, Consultant & Contractor*)

45) Project Construction Management As Individual Professional Service:

The project concerned professionals considered it as not an important origin because they feel that as an individual professional service it provides better opportunity for professional to work most neutral way. The designer and consultant have ranked it as not important origin. (*Designer, Consultant*)

Project construction management as an individual professional service is a better way to accomplish a project with minimum dissonances between professionals. This may cause project management professionals to spend considerable time to comprehend the project and its extents before they plan out the management strategies for project completion. Eventually project construction management as an individual service brings professional at an amicable working environment which eventually lessens the dissonances between concerned participants. In this case there is minimum risk for professionals to blame other professional for any problem in project completion chains. The contractor has ranked this origin as important origin of dissonances. (*Contractor*)

6) Conclusion:

The conclusions are based on the analysis, the results of the survey indicate the following conclusion;

Lack of Coordination between Professionals:

According to the analysis, the **top most important** origin of professional dissonances is “lack of coordination between professionals”. It was quite expected from the research, considering the coordination as the backbone of any working relationship. The professionals have accepted the significance of coordination between professional while

considering the particular projects as well as previous professional experience in construction industry. It is quite vital in a multi participants environment as construction project to keep strong and continuous coordination. Designer and contractor should have professional coordination between themselves, because through the project completion they have to work at different interfaces of project processes. Lack of coordination between dyad initiates professional conflicts and eventually impacts the project adversely, as lack of coordination tends to augment the errors which usually can be resolved before they affect the project in any respect.

Insufficient Working Drawing Details:

The **Second most important** origin of professional dissonances, according to the combined evaluation, is “Insufficient Working Drawing details”. As the lack of information on working drawings lead the professionals away from original stipulated goals of project. The professionals have accepted the significance of insufficient working drawing details, while considering the particular projects as well as previous professional experience in construction industry. Insufficient working details originates quite a significant dissonance between the professional cause the designer would like to get the work done according to his best perception, whereas if he doesn’t provide sufficient information on working drawings, the contractor would not be able to comprehend the actual sense of stipulated job. Eventually it is a potential origin of dissonances between the parties.

Involvement of Designer as Consultant:

“Involvement of Designer as consultant” is the **Third most important** origin of professional dissonances on design and construction interfaces. It is quite obvious from the results that the respondent professionals that involving the designer as consultant provide hindrances in the way of project pace. Eventually the solution to this particular discrepancy is the availability of a neutral party as consultant on the project. It can be an origin for potential dissonances because if the designer as design consultant strive to overcome their design errors and blame those on the contractor, occasionally there is possibility for the contractor to face resistance in pointing out the design errors or ineffective design specifications. In case of designer as design consultant, there is possibility that the designer would cover his faults and blame it to other participant.

Involvement of Contractor as Consultant:

Fourth most important origin of professional dissonances, as concluded from the statistical analysis, is “Involvement of contractor as consultant”. As expressed in the above section that the involvement of contractor tends to initiate discrepancies between professionals on project design and construction interfaces. Involvement of contractor as consultant is an origin for potential dissonances because if the contractors as consultant strive to overcome their construction errors and hide those errors or over cost the activities then keeping the project on the right track and getting the best out of that becomes very difficult. Eventually there is possibility for the designer to face resistance in rectifying the construction according to stipulated design and specifications. In case of

contractor as consultant, there is possibility that the contractor would cover his faults and blame it to other participant.

Participants' Honest Wrong Beliefs:

“Participants' Honest Wrong Beliefs” and “ Contractor's lack of comprehension of drawing details and specifications” are considered as **Fifth most important** origin of professional dissonances on project design and construction interfaces. Considering the comprehension of drawing details is the integral part of pursuing the project with least errors. The participants' honest wrong beliefs cause the rigidity in professionals attitude, eventually that initiates hindrances for project pace. Participant's honest wrong beliefs leads the professional towards poor value in projects. This occurs when contractor and designers, without having first hand knowledge, make decisions based on assumed user needs. Eventually, honest wrong belief is one of the major origin of potential dissonances between designer and contractor on project interfaces.

Project management as individual professional service:

According to the analysis, the **Top least important** origin of professional dissonances is “Project management as individual professional service”. It was quite expected from the research, that the project management as individual service is quite welcomed from all the respondent firms, because that provides fair working relationship between all the participants of project on design and construction interfaces. Eventually it is an excellent solution to the risks in involving contractor or designer as consultant.

Involvement of Contractor in design conceptual phase:

“Involvement of Contractor in design conceptual phase” and “ Nationality of contractor and design firms” are considered as **Second least important** origin of professional dissonances on project design and construction interfaces. It was quite unexpected results from the study, which revealed that the contractor involvement in design conceptual phase is welcomed by the respondents and designers don't consider it as threat of hindrance for their professional system, which is not conventionally carried out in construction industry. As the majority of the construction industry is consist of human resources from various nationality, it is quite soothing indication that different nationalities don't initiate any severe professional dissonances.

Involvement of Contractor in design development phase:

“Involvement of Contractor in design development phase” is considered as **Third least important** origin of professional dissonances on project design and construction interfaces. As mentioned above in the previous section, It was quite unexpected results from the study, which revealed that the contractor involvement in design development phase is welcomed by the respondents and designers, which is not conventionally carried out in construction industry. Eventually it is an excellent solution for overcoming the risks in case of lack of comprehension of drawing details and specifications by contractors.

Weather Conditions:

According to the analysis, the **Fourth least important** origin of professional dissonances is “Weather Conditions”. It was quite expected from the research, that the

weather conditions are quite comprehensively planned and considered by the professionals as conventional practice prevails in construction industry.

Unforeseen Problems:

“Unforeseen Problems” is considered as **First least important** origin of professional dissonances on project design and construction interfaces. It is considered as the origin which would have tendency to initiate some conflicts of rather low intensity between professionals

7) Recommendations:

Recommendations are developed while considering the findings of the research as elaborated in the previous section, and also referring the findings of previous studies expressed in the literature review. The recommendations are revealed as follow;

- a) As revealed in the analysis and conclusion segments, the marked top dissonance origin is reported to be the “lack of coordination” and “insufficient working drawing details”, eventually the solution to this particular discrepancy is also revealed in the analysis and conclusion segments as in the form of least important origin, and that is the involvement of contractor in design conceptual and development phases as the professionals considered this particular involvement as quite helpful in their professional system. Therefore it is recommended that contractor should provide his input in these phase for it not only improves the design on reality ground but also provides an opportunity to overcome the discrepancies in working drawing details as well as an

opportunity for professionals to develop better coordination for optimum working relationship.

- b) Considering the other important origin of professional dissonances as reported by the respondents, “the involvement of contractor as consultant” and “involvement of designer as consultant”, eventually the recommendations to overcome this particular discrepancies are also revealed from the analysis of responses received from all respondents. That is considering the “project management as individual professional service” it provides least conflicts between professionals, because in this case the professional don’t face risk of being bias by any participants on project design and construction interfaces.
- c) It also recommended the participants should have better coordination through involvement of project management professionals as independent participant on the project, which eventually brings the professionals at a common platform to develop better coordination as well as to overcome the important origin of professional dissonances as “participants honest wrong beliefs”. Because through better coordination and working environment the professionals get opportunity to discuss and rectify their honest wrong belief, which consequently provides better grounds for project pace.

The recommendations divulge from the research study is that there is an intense need of reducing the schism between the contractor and the designer on project interface. Therefore to reduce that schism it is recommended to have a neutral participant who intends to act as bridge between the two professionals and to bring them on some amicable professional platform. That neutral participant would be the designer or the

contractor depending on the circumstances if the designer or contractor is hired as independent party and has nothing to do with actual design and construction activities, whereas the professional supposed to be only concerned with the consultation of design and construction activities of project.