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Influence of fit and flexible human resources on IT project performance

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Abstract

This research investigates in the context of outsourced IT projects the influence of ambidextrous 'exactly skill aligned or fit' and 'skill and behaviorally flexible' human resources (HRs) on project performance. The study argues that the human resources that are narrowly and exactly skill alignedto the clear project specifications provide productivity gains, and flexible human resources provide project slack of experience and multiple skills to cope up with the unpredictable 'change requests' asked by the clients during project execution. Latter also help to cope up with the uncertain coordination problems cropping up during project execution. Both exactly mapped HR ability (fit) and HR flexibility (HRF) show unique influences on PP. The planned slack of HRF influences PP mediated by executed HRF of skill and behavioural kind. Skill flexibility moderates negative influence of changes requests and coordination challenge on PP. The HR planning models in the extant research in IT project management implicitly assumes that all project needs are known at planning stage and required HR skills are available whenever needed. This research refutes these assumptions and tests a dual- dynamic model of HR planning and execution embedded in the theoretical framework of HR ambidexterity.

Keywords: IT Project performance; Human resource allocation; Human resources fit and flexibility; Human Resource ambidexterity.

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1.0 Introduction

Vendor organizations executing outsourced software development projects through globally distributed model (GDM) face twin challenges of keeping the costs and time of execution low, and accommodating most of the client's requests, including changes at various stages, to maintain business continuity with the client. The twin challenges require appropriate human resource planning and allocation,and in its absence many software development projects fail (Silva & Costa, 2013). A few studies on the subject have focused on identifying human resource allocation models optimizing the skill levels and experiences of human resources in IT projects with the objective being either minimization of the time required or project costs incurred to complete the project (Tsai et al., 2003; Otero et al., 2009; Silva & Costa, 2013) or maximizing the synergy within the project team (Andre et al., 2011). The modeling based approach focuses on mapping the project needs onto the skills of available human resources. These studies have demonstrated that an optimal fit or alignment between project needs and skills leads to better project outcomes, including lower costs and timely execution.

The modeling based studies assume that all project needs of human resource skills and competencies can be identified at the planning stage itself (Andre et al., 2011). Also that appropriate human resources with these skills and competencies would be available and an alignment between the available and the needed skills can be achieved. Both assumptions are often difficult to achieve. In the outsourced software development projects,the project needs are often not very clear at the planning stage (Ebert & De Man, 2005) and lot many change requests from the client would be raised once the project gets underway (Javed,Maqsood & Durrani, 2004). Appropriately 'fit' human resources are also often not available because of fast changing technologies in this industry leading tomany IT project failures (Sommers &Nelson, 2001;Otero et al., 2009).The globally distributed IT projects, that this study investigates, also face challenges of coordination -internally within the distributed team and externally with the clients; challenges that are interpersonal in nature, communication overheads and so on (Ebert &

De Man, 2005; Wallace & Keil, 2004). The aforementioned dynamism and unpredictability result in high performance risks (Nidumolu, 1996). This risk needs to be responded by incorporating dynamic element to the human resource allocation and planning, not captured in the model based research cited above.

This study addresses the above research gap by proposing that project managers during HR planning build up a slack of experienced and multi- skilled human resources by drafting in such resources right at the beginning to cope up with the uncertain 'change requests' and 'coordination challenges' that would crop up during the project execution. Though such a buffer HR flexibility raises the project cost, the paper argues that alternative of just-in-time drafting of HR skills in response to contingencies is less feasible in IT projects. This HR flexibility is complemented with planning and drafting of lesser experienced and narrowly skilled low cost team members, who align exactly to the part of the project needs that are well defined, specific, and certain, thus providing productivity gains and lower costs of project execution. Lower overall costs and faster execution are the competitive advantages of the outsourced IT projects executed by the Indian IT firms. This research investigates the influence of such a dual HR capability- of exactly aligned HR, and flexible HR on project performance (PP), and the moderating effect of HR flexibility in mitigating the negative influence of unpredictable requirement changes and coordination issues on PP. The duality of HR 'fit' and 'flexibility' plays critical role in the project success and this study empirically investigates it, a research gap left unaddressed in the extant literature.

This research contributes to the IT project management literature by applying the theoretical frameworks of HR duality of 'fit' and 'flexibility' (Wright & Snell, 1998; Korczinsky, 2004), and ambidexterity (Gibson & Birkinshaw, 2004) to HR planning in uncertainty. It extends the notion of resource- need fit, dealt as a static unidimensional construct in the modeling based research, to a construct that is dual- dynamic – ambidextrous. This dynamism and ambidexterity is demonstrated by investigating the duality of HR fit and flexibility at the project planning and the execution stages and studying its role in managing the performance risks and the project performance. To the best of authors' knowledge, such

dynamic – dual – multistage model has not been developed and tested in the extant research either in the IT project management literature or in the mainstream HRM literature at project level of analysis.

2.0 IT Project Management: Global Delivery Model context

This research is conductedin the IT firmslocated in the mature Indian IT services industryexecuting outsourced projects for the global clients located primarily in the US and Western Europe. IT services industry has typically followed "managing by projects" as a strategy to serve their clients. Majority of the IT services firms in India have adopted global delivery model (GDM) - a unique approach to IT project implementation using globally distributed teams executing projects. In this approach, projects are broken down into logical components called modules, and distributed to different locations (onsite, nearshore and offshore) to optimize value offerings to the client (Delong, 2006). The distinct and central feature about such IT projects is the distributed and closely coordinated nature of work that onsite client facing team and the offshore development teams execute. At the client location, activities such as analysis and planning, high level software design or architecture, user interface design, project co-ordination, onsite testing and implementation are carried out during different phases of the project. At the offshore development centers, tasks such as project management, detailed/low level design, coding, testing, documentation, bug fixes, warranty support and maintenance can be done in a cost efficient manner. The client facing team requires higher end analytical and consulting competence whereas offshore team needs predominantly coding and project coordination competencies. The onsite team works with the client during the day to capture the design of the process object. At night, the offshore team in India converts the design templates into a software configuration. On the following day, the onsite team would test this with the customer and undergo a second iteration, if necessary, achieving almost 24 hours work process.Using this model, IT firms in India have been able to perform major engagements for a lesser blended rate than the traditional model where all tasks are performed at the same location (Capur &Burgelman, 2006).There is a dual need for high execution efficiencies to keep the projects costs low and need to manage requirement volatility and coordination challenges cropping up because of project execution being carried out at different locations and different time zones (Chandrasekaran & Ensing,

2004). ThusIT projects provide unique attributes that are distinct from other project contexts. The globally distributed nature of project teams, simultaneous emphasis on low costs and flexibility, higher degree of dynamism and uncertainty (Huemann et al., 2007), knowledge and higher end skills centricity, relatively shorter duration of projects, and international clients are such features that make investigating IT projects context relevant to the research questions raised in this study.

2.1 *IT Project Performance: Criterion variable*

In the case of IT projects, the definition of a project and its success factors are complex and multi-dimensional owing to the environmental dynamism, skill requirements, and multi-location execution. Nidumolu (1996) considered *process control* and *product flexibility* astwo important dimensions of software-development project performance.Measurement of software project performance may encompass the process objectives (budget, cost, and efficiency), product features (quality, features, and price), stakeholders expectations (meeting business objectives, development team learning, and customer satisfaction) and the business value of the project for the client and the vendor organizations (DeLone & McLean, 1992; Kerzner, 1995; Nidumolu, 1996; Shenhar et al., 2001; and Thomsett, 2003). Project Performance (PP) in this research is defined as *the assessment of how well the project's objective parameters – time scales and budget were met along with the subjective parameters such as satisfaction of client's business objectives, meeting user expectations, and creating value for the vendor organization at each milestone of the project.*

3.0 Key Performance Risks and IT Project Performance (PP)

The key sources of uncertainty inthe IT projects are the unanticipated change -requests raised by the client during the project execution and various coordination challenges arising within the project team and from the client side. These two factors enhance the performance risk and are often viewed as the highest contributors to the inefficiency and poor performance of a software project (Keil et.al., 1998; Lamsweerde, 2000). This is especially true for the projects that are outsourced to the global vendors such

as those located in India serving clients situated in developed markets in US and Western Europe. Performance risk refers to the difficulty of estimating a project's performance consequences (Nidumolu, 1996). Key reasons for high performance risk leading to project failures are insufficient management of requirement volatility and customer mandate, and execution risks during all stages of the project life cycle (Ebert & De Man, 2005).

3.1 Influence of Requirement Volatility on PP

*Requirement changes can be effected in form of addition, deletion, and modification from the initially agreed upon specifications and the degree of such change requests during project execution is defined as requirement volatility in this research.*Often the modifications demanded by the clients are unanticipated and may need re-working several parts of the software due to the inherent interdependency in the projects. Also the lead time to respond is very less as highly efficient and productive execution is the key to the project success. Extant research has shown that scope creep or changing requirements during the implementation of an IT project adversely affects the performance including delays and cost escalations (Pfahl & Lebsanft, 2000; Reifer, 2000; Zowghi & Nurmuliani, 2002) and cause interpersonal conflicts between IT team and users affecting project performance (Liu et al., 2011). Therefore, it is hypothesized that:

Hypothesis 1*: Requirement volatility will have a negative influence on project performance*.

3.2 Influence of Coordination Challenges on PP

Project-based organization, compared to the conventional forms of organization, is associated with the management of complexity due to higher degrees of *differentiation* - the number of varied elements, e.g. tasks, specialists, components and *interdependency* - thedegree of interrelatedness between these elements (Baccarini, 1996). Outsourced IT projects are inherently more complex due to higher degrees of differentiation and interrelatedness (Xia & Lee, 2004) because of distributed GDM and hence prone to

higher degree of performance risks and failure.For example, there are multiple stakeholders- client users, client IT teams, Client management, project manager, client facing vendor teams, and different offshore modules of the project (Nidumolu, 1996). Because of these elements and need for managing the interdependency between them, huge coordination issues are inherently present in IT project management.

Coordination in the projects is the process of bringing together and synchronizing the efforts, the intent, and the processes of different stakeholders so that the project outcomes are superior. Coordination challenges during project execution poses significant performance risk, the origin of coordination issues being either the client or the team (Keil et al., 1998). Client commitment and involvementthroughout the project during different phases is critical for the project success (Boehm, 1991). The clients are involved in critical phasessuch as requirement analysis, service level agreements, approval of sub-project milestones, intermediate product documentation, and need to work closely with the IT vendor so that project moves smoothly. The influence of client behaviour on project performance is multifaceted and involves schedule restrictions, insistence on frequent progress reports, approval delays, and project scope-creep (Rodrigues & Williams, 1998). The project team has to provide interface and coordinate these client driven challenges effectively. *Client coordination challenge (CCC) is defined as the amount of effort expended by the IT project team/ PM to bring about synchronization in the intent, effort, and processes (e.g., communication) of the vendor and the client teams related to project management, the need arising because of the client either due to their lack of commitment, or communication gaps, or changing needs*.

Team coordination challenges comprise of all the issues that are related to the vendor's team. These issues could emerge due to poor team dynamics and cohesion, unplanned leaves taken by the team members, a team member quitting the project or the company at critical stages of the project, and other such contingencies(Wallace & Keil, 2004). And these issues are exacerbated by the distributed nature of teams that require coordination among various modules. *Team coordination challenge (TCC) is defined as amount of effort that is expended by the team /PM to bring about synchronization among the team members and different modules in the intent, effort, and processes related to project management.* The

coordination issues can be detrimental to the PP (Ebert & De Man, 2005; Xia & Lee, 2004) if not controlled by proper planning and able leadership. It is hypothesized that:

Hypothesis 2:*Coordination challenge originating from the client end or from within the project team has negative influence on the project performance.*

4.0 ManagingDuality of Efficiency &Dynamism:Role of human resources fit & flexibility

One of the key values that the outsourced IT projects create for the clients is the low cost at which these projects are delivered. Therefore, the efficiency of processes and productivity of resources is critical for project success. However, due to the nature of such projects, these projects also face high degree of uncertainty, dynamism, and performance risk, posing a threat to project success. This risk has to be handled appropriately by careful project planning and execution. Due to these twin challenges, human resource planning in IT projects has to incorporate simultaneously dual logics of tightly aligned human resources mapped exactly to the sharply specified needs identified in the requirement analysis stage, and human resources that provide higher degree of flexibility of skills and behavior (Wright & Snell, 1998) to meet the uncertain contingencies or performance risks during project execution.

In uncertain environments, both constructs of fit and flexibility are necessary and the two can co-exist and complement each other (Milliman, 1991), despite seemingly contradictory nature. The two have different natures- fit is a *state* of alignment of systems/policies/ processes with organizational elements such as strategy, and flexibility is the intrinsic *ability* to adapt, and hence the two can co-exist (Wright & Snell, 1998). In an unpredictable environment, achieving HR fit can only be ensured over time when HR flexibility exists in the system. At the organizational level of analysis, in uncertain environments, the dual need of resource fit and flexibility has been investigated in strategy literature as a capability of *ambidexterity* (e.g., Tushman & O'Reilly, 1996; Gibson & Birkinshaw, 2004) and, to lesser extent, in SHRM literature as HR fit and flexibility (Milliman, 1991; Wright & Snell, 1998). At micro employee level, in the service industry context, Korczynski (2002) investigated construct of *customer oriented*

bureaucracy bringing out the seemingly contradictory duality of need for frontline employee to be simultaneously operationally efficient and yet customize their response to variable, unpredictable needs of customer. In both literatures evidence exists that such duality, if rightly obtained, leads to superior performance outcomes.

4.1 Duality of Human resource planning and IT Project Performance

In this research, we extend the above argumentsof the need for duality of HR fit and flexibility to the human resource allocation process in IT project context. Human resource allocation process is one of the most critical processes to achieve IT project success because people resources play critical role in ensuring quality and productivity outcomes in IT projects (Otero et al., 2009; Silva & Costa, 2013). Ethiraj et al. (2005) identified "effort estimation and management capabilities" as critical capabilities of software vendor necessary for successful IT project management. This capability includes the ability to identify appropriate resources – necessary skills, experience, and availability, and use of prior experience and data to accurately estimate resource needs.

Thus the project managers have to ensure that the skills and experience of the team members drafted in the project 'fits' the needs of the project as identified in the requirement analysis process and service level agreements. Fit is defined as "the degree to which the needs, demands, goals, objectives and/or structure of one component are consistent with the needs, demands, goals, objectives and/or structure of another component" (Nadler & Tushman, 1980: 40).We have conceptualized a construct-Degree of Resource Alignment (DORA) to capture the HR fit that project managers would aim to achieve at the project planning stage. DORA is defined as *the extent to which the human resources allocated to the project at the planning stage have skills and experiences appropriate to the requirements of the project.* DORA definition implies two dimensions – exact resource alignment or exact mapping of resources to specific well defined project needs and provision of flexible resources to cater to the uncertain dynamic project needs that may crop up later on.

As cost efficiencies obtained in execution of outsourced IT projects are critical for project success, close alignment of HR needs and team capabilities is one important goal of project planning. In projects with clearly laid out requirements, known technology base and longtime clients, it is possible to exactly map the human resource capabilities according to the initial project specifications. In routine projects with far lesser performance risk of change requests from the client end, the project managers would like to allocate lesser experienced, narrowly skilled, cheaper resources and focus on higher productivity to gain profits (Otero, et. al., 2009). Even in more complex projects, managers would like to optimize the resources between lesser experienced, narrowly skilled, but cheaper resources for standard and known parts of the project, and more experienced multi-skilled but expensive resources. Therefore, *one dimension of resource alignment is the exact and accurate mapping of human resources on to the specific and unambiguous projects requirements called exact resource alignment* (ERA). Wright & Snell (1998) argued that in stable, predictable environment, firms may achieve tight fit of resources with demands by developing narrow range of exact skills and eliciting narrow range of specific behavior.

However, the uncertainties originating from the client end, from within the team, and coordination issues within the distributed team and with the clients, impliesthat experienced and multi-skilled resources or the 'flexible' resources are the best fit. In the projects that are complex, or where either the technology is new for the vendor organization or the client is a newly acquired one, often highly experienced resources are deployed so that troubleshooting in real time becomes easy, what Collyer & Warren (2009) referred as resource based input control in dynamic project planning.Pich et al.(2002) and Meyer et al. (2002) have mapped the nature of uncertainty faced in project planning – ranging from expected variations in cost and schedule goals, to foreseeable and unforeseeable uncertainties, and finally to utter chaotic planning scenarios. Theyargue and provide evidence that performance risks associated with expected variations are best handled by keeping cost and schedule buffers. Managing risk associated with foreseeable uncertainties, events that are possible but it is not known whether these will happen (Pich et al,.2002),would also need such buffers and contingency planning. IT service projects executed by vendors based out of India and investigated in this research focus a great deal on long term contracts and

repeat orders from the same clients (Ethiraj et. al., 2005). This strategy helps in reducing the project risk significantly by making uncertainties driven by client fairly predictable or foreseeable. The IT vendor develops explicit or tacit knowledge about specific client and such knowledge helps firms to customize their project planning and allocation of resources.

Such client driven foreseeable uncertainties are managed by drafting in multiskilled human resourcescapable of dealing with contingencies as they arise. Unforeseen client driven change requests require training of project team members (Otero et al., 2009), if it is feasible, or drafting in human resources from outside the project when the need arise. Multiskilling and behavioral adaptability of team members is also necessary in IT projects to manage intra- team coordination issues because of the distributed -modular nature of IT projects. Further human resource skill and behavioral flexibilities help in managing uncertainties arising because of the internal team factors such as unforeseen attrition of team members. *The provisioning of human resource flexibilities at the project planning stage by way of more experienced, adaptable, and wider skilled resources is the second dimension of "fit" termed as planned human resource flexibility (PHRF).*

Flexibility is a form of slack (Pich et al., 2002). Therefore, in case of IT projects, managers provide for some 'slack' in the form of more experienced resources with wider skill sets to tackle any emergent contingency effectively during implementation. Human resource slack creation in IT projects, like 'bench strength', is a deliberate flexibility to address the strategic and operational challenges (Otero et.al., 2009).It needs to be pointed out that slack is costly for the project, and manager has to arrive at an optimal balance between such resources and the relatively less costlier ones that have exact and narrower mapping to project needs, implying their lesser experience as well. Also, the alternative option of bringing resources from outside the project as and when scope creep happens is not preferred by project managers because of multiple reasons. Kang et al. (2011) identified following constrains with such alternatives in software projects planning-firstly the required expert resource at the time of need may not be immediately available because of their heavy engagement in other projects, secondly the new person would need time to understand the project, and thirdly often the team cohesion gets affected if a new resource is added

later on to the team. Given that IT projects are of relatively shorter duration and project managers cannot afford above challenges, they rather prefer to involve such resources right from the beginning, even as slack. This also came out very clearly during interactions with the project managers while conducting the study.

By mapping resources or ensuring "fit" against very specific and exact project requirements or ERA and provisioning for options by building "flexibility" to ensure "dynamic fit" in face of uncertain project needs, project managers build in ambidexterity (Gibson & Birkinshaw, 2004). Understanding the skill and experience of the resources and mapping them accurately to the project needs is a significant part of project planning. It is thus hypothesized that:

Hypothesis 3*: Degree of resource alignment and its two dimensions- ERA and PHRFhave positive influence on project performance*.

5.0 Execution HR Flexibility and Project Performance (PP)

Degree of Resource Alignment or human resource fit at the planning stage is only the HR potential or ability that project team possesses. For this potential to convert into actual behaviors, willingness of these resources is also critical (MacDuffie, 1995). These behaviors include very specific pre-defined efficient contributions, and the flexible behaviors based on broad skills and experience of some members to address unanticipated project requirements that may arise from client. In this study, for parsimony purpose, we have not measured the execution of exact pre-determined skills and focused on the execution of flexibility dimension. The implicit assumption behind leaving the former is that once such exactly aligned resources are drafted in the project team, these resources would follow the expected standard behaviours that allow firms to achieve efficiency goals. The flexible behaviors may be needed from all team members for smooth coordination and communication across different project modules, for adjustments needed from members arising out of changes in the team, and for quick learning of new skills, if required. Thus execution of exact and specific HR skill and knowledge for routine part of the project

for efficiency gains is important, but the execution of skill and behavioral flexibility is more critical when many new requirements and coordination challenges crop up during the project implementation (Wright & Snell, 1998).

Drawing from the conceptualization of HRM flexibility in mainstream HRM literature (Wright & Snell, 1998), we have conceptualized a construct labeled as execution human resource flexibility (EHRF) defined as *the extent to which human resources in projects actually exhibit flexibility in real time because of broad base of skills and/or because of adaptable behaviors.* EHRF has two dimensions – executed skill flexibility and executed behavioral flexibility. Former comprises of multi-skilled contributions by the project members. Latter comprises of invoking of varied behavioural scripts, including work stretching, quick learning behaviour, adaptability to different roles, and interfacing with different modules. Some behaviours such as adapting to different roles will be facilitated by executed skill flexibility (Wright & Snell, 1998) but will need willingness from the employees to enact such adaptation. In the mainstream HRM literature, no study hasinvestigated the direct influence of integrated HRF on project performance. Therefore,

Hypothesis 4:*Execution human resource flexibility and its two dimensions- skill and behavioral flexibility have positive influence on the project performance.*

6.0 Moderating Effect of EHRF

While it is argued above that the skills and behavioral flexibility are central features of most of IT projects owing to distributed teams, modularity, and global clients, the main reason resource flexibilityor slack is created is to counter the negative influences of unpredictable requirement volatility and coordination challenges on PP. EHRF in the project mitigates the negative effects of requirement volatil**i**ty and coordination challenge on project performance by allowing project manager and team to quickly and effectively meet the unanticipated challenge that may crop up within and from the client end. It is argued that this moderating influence of EHRF and its two dimensions may even be greater than their direct

effect on PP.We also argue that such moderating influence provides a form of 'dynamic fit' (Anand & Ward, 2004) with EHRF meeting the dynamic need that arose. Therefore it is hypothesized that:

Hypothesis 5*:EHRF and its dimensions will moderate the effect of requirement volatility (RV) on project performance such that when EHRF is high then the negative effect of RV on PP is lower.*

Hypothesis 6:*EHRF and its dimensions will moderate the effect of coordination challenge (CC) on project performance such that when EHRF is high then the negative effect of CC on PP is lower.*

7.0 Mediation of PHRF–PP relation by EHRF

We expect that EHRF would partially mediate the influence of planned HR flexibilityon project performance. We are positing partial mediation only because the experienced multiskilled resources providing flexibilityalso contribute positively to the efficient execution of exact and narrower skill requirements. Such resources being experienced, also contribute to better management of the project.It needs to be pointed out here that flexibleresources are chosen for a project owing mainlyto their wider skill repertoire and experience. However, skill flexibility also implicitly lends such resources more adaptability or behavioral flexibility (Wright & Snell, 1998; Ketkar & Sett, 2009). Thus,

Hypothesis7*: EHRF and its two dimensions partially mediate the influence of planned HR flexibility dimension of DORA on PP.*

8.0 Control Variables

We have controlled for project complexity and quality of project leadership. Greater complexity is associated with unclear identification of goals and objectives of projects, project delivery delays, cost overruns, lower client and user satisfaction, and poor system functionalities (Baccarini, 1996; Xia & Lee, 2004).Also quality of project management is important for project success. By controlling the complexity

of the project and quality of project management, we are able to demonstrate that human resource flexibility is essential for success in any IT project.

9.0 Method

9.1 *Research Design and Data Collection*

We have used survey method to collect data from the IT firms in India. The questionnaire used has 31 items and we sought around 200 data points for hypotheses testing to achieve adequate power of test (Nunnally, 1978). The unit of analysis of the study is a 'project' within an IT firm. We collected data from firms withCMMi (Capability Maturity Model Integration) level 5 and ISO 2000 quality certifications. These criteria ensured that all firms had similar standardized software development process, thereby controlling for the influence ofsoftware development process maturity. We chose those companies which are into all ranges of software projects in orderto capture representative sample of the population studied.

There were fifty one firms based in India meeting the criteria defined above. Out of these firms we approachedeighteenfirms that hadcomparable standing in terms of size, performance, and the nature of projects. Only threefirms decided to participate with one providing data from two locations. The first author visited all four locations to collect data aiming for around fifty data points from each location. In order to achieve external validity, the sampling plan covereddifferent types of projects, as is evident from table 1.

Insert Table 1 about here

Project managers (PM)were the respondents for the study. Theyhad the overall responsibility of project management including responsibility for managing the human resources of the projects. In HRM research focused on organization level policies or processes, single respondent design has often been used (e.g. Batt, 2002; Ketkar and Sett, 2009) and so it was considered appropriate for this study as well. The

respondents on an average had respectively 9.8 and 7.4 years of total IT work experience and experience in the respective firms.

We collected data from the project managers on retrospective basis. The average completion time of a project being 6 months to 1 year, PMs would be able to respond to the latest completed project.After testing for outliers and data cleaning, we used a final sample of 189 for analysis.

9.2 *Questionnaire Development*

The authors could not find in the extant literature similar studies conducted on IT projects in the GDM context. Therefore, we had to develop most of the scales from the existing literature, views of the experienced IT project professionals, and academicians in MIS. We extracted key attributes, adjectives and few items from theIT project management literature for the following constructs- exact resource alignment and planned human resource flexibility from Ethiraj et al.(2005), Otero et al.(2009); requirement volatility from Nurmuliani et al. (2004), Thakurta & Ahlemann (2010), Ferreira et al. (2011); client coordination challenge and team coordination challenge from Keil et al. (1998); Wallace & Keil (2004). For skill and behavioral flexibility we extractedkey attributes from Bhattacharya et al. (2005) in HRM literature. For project performance construct,Xia and Lee (2004) used delivery time, project cost, product functionality, and user satisfaction. Thus we included items measuring these attributes and also included one item capturing the impact of project experience on the vendor organization's project management process. All scales were Likert type scales with a range of values 1 to 7 anchored respectively to descriptors ranging from 'strongly disagree' to 'strongly agree'.

The preliminary items were tested for face and content validity by interviewing 14 IT project management professionals from firms executing projects mainly for global clients using GDM and couple of experienced academicians from the IT management field. Based on the feedback some items were added, deleted, or reworded.

A pilot study was essential because all scales were new and required tests of reliability and dimensionality.Based on the pilot study data of 38 IT projects, we conducted exploratory factor analysis

(EFA) on each scale separately to test the dimensionality.The respondent and the project profiles were similar to the main study data. In pilot test all the values of Cronbach alpha were above 0.6excepting that for coordination challenge, acceptable for developmental scales (Nunnally, 1978). In EFA tests all individual items had a minimum factor loading of 0.5,though some items cross loaded on other factors. Since all scales were new, many scales/ items did not behave as expected in these tests. Post analysis probe questions were asked from respondents to look for ambiguities, double barrel items, and misunderstood items. Some of the items were added, deleted and re-worded after the pilot test.

CFA and Convergent- Discriminant Validity:Since changes were made in the scales after the pilot, to confirm dimensionality,predictorand PP scale items were separately allowed to freely load (EFA) on to the latent factors. As is evident in the tables 2 and 3, most of the items loaded as expected on the defined constructs. PHRF and executed skill flexibility aligned on one factor representing the shared variance,and items related to customer coordination challenges cross loaded on requirement volatility. Therefore the scales were further tested for convergent - discriminant validity to establish their construct validity.

Insert Tables 2, 3 about here

The predictor scales were tested for convergent - discriminant validity by running Structural Equation Modeling (SEM) analysis on a 'nomological network' of predictor constructs (the dimensions of constructswere allowed to co-vary with each other in the structural model). In order to establish convergent validity, average variance extracted (AVE) and composite reliability estimates were calculated for each construct correlated in the model. AVE was > 0.5, the recommended cut –off value (Fornell &Larcker, 1981) for all scales except that it was > 0.4 for executed skill and behavioral flexibility. Composite reliability was> 0.7 for all scales except that it was > 0.6 for executed skill and behavioral flexibility scales. For developmental scales, it is acceptable range (Nunnally, 1978). The discriminant validity for each construct was established by testing whether √AVE for each construct >correlation(σ)it

has with all other constructs (Fornell &Larcker, 1981). For all combinations, including PHRF and executed skill flexibility, client coordination challenge and requirement volatility, the discriminant validity was established based on the above criterion. Lastly the SEM based CFA tests revealed that constructs fulfilled acceptable cut- off values[3] for most of the parameters.Overall analyses reveal modest but acceptable statistical properties for scales, given that these scales are still in developmental stage.

The control variables of project complexity and quality of project management were measured using proxy indices. Project complexity was measured as an equal weighted additive index of following three dimensions capturing the nature of the project: project type, life cycle model used, and pricing model used (refer table 1), with projects given ordinal values on these three dimensions in order of their increasing probable complexity- combination more than maintenance, agile more than waterfall, and mixed more than fixed. Project management was measured as an equal weighted additive index constituting of log of work experience of project manager and ordinal values assigned to their level in the organizational hierarchy.

Single respondent data is susceptible to common method bias and so to check for its influence CFA was conducted by considering all items of both the independent and the dependent variables in a single factor and examining the fit indices (Podsakoff et al., 2003). The hypothesis that a single factor (common method) accounts for very large variance in the data was ruled out due to poor fit indices (χ^2 / df = 5.853; RMSEA = .161; GFI = 0.513; PGFI = 0.424; CFI = 0.428; PCFI = 0.388).

10.0 Results

Table 4 presents the descriptive statistics. Most of the correlational values are statistically significant at $p < 0.05$ and in the expected directions providing initial support for most of the direct relation hypotheses.

Insert Table 4 about here

[3]Acceptable range: GFI> 0.9; PCFI> 0.5; CFI>0.8; RMSEA< 0.08 (Hair et al., 1994)

In the regression of project performance on degree of resource alignment and its two dimensions,DORA and ERA showed significant positive effect on project performance. However, the bivariate correlation value of PHRF with PP was significant ($\sigma = 0.29$, $p<0.01$). A modest positive influence of PHRF could be either due to the modest statistical property of the scale (Cronbach $\alpha = 0.63$) or because of the fact that anticipated flexible behaviors may not have been realized or neededas planned in every project.

Insert Table 5 about here

Then PP was regressed on execution stage variables. The results revealed significant direct effects of requirement volatility, EHRF and its two dimensions, and client coordination challenge constructs (Table5) providing support to hypotheses 1, 2 and 4.

We used SEM to test hypotheses as model shown in fig1. We dropped the direct effect of PHRF on PP from SEM model because regression analysis revealed (table 5) insignificant effect, probably because PHRF has only got indirect mediating effect. The tested model had moderate fit with data with $\chi 2/$ DOF = 2.07, RMSEA = 0.075, PCFI = 0.734, CFI = 0.85, and TLI= 0.83 being within the acceptable range. All relations were found to be significant providing support to hypotheses 1-4 and 7. While SEM showed support to mediation hypothesis 7, we used PROCESS macro in SPSS 19 recommended by Hayes (2013) to test the mediation effect[4]. The test showed a significant full mediation effect proving the hypothesis 7 for full mediation.

Insert fig 1 about here

We then tested moderating effect of EHRF and its dimensions (hypotheses 5 and 6)by using hierarchical regression. These tests were conductedusing the centralized values of independent variables to avoid the multicollinearity issue due to interaction terms. The results of this regression are presented in table 6 for

[4] Results on PROCESS based mediation analysis can be shared if asked for.

moderating effect of SF only, the only significant moderating effect. Themoderating effect was in the expected direction providing partial supportto hypotheses 5 and 6. Notablythe effect size of moderating effects of SF was comparable to the direct effects of SF.

Insert table 6 about here

11.0 Discussion

11.1 Project Planning in Uncertainty: Duality of ERA and HR flexibility as fit

By investigating the impact of human resource planning and executed flexible behaviors, this research contributes to an under researched area of studying impact of HRM onproject performance (Turner &Muller, 2003; Huemann et al., 2007; Silva & Costa, 2013; Keegan et al.,2012; Keegan et al., 2018). At planning stage the results of this study support the HRM 'fit' hypothesis at the project level of analysis. The two dimensional 'degree of resource alignment' construct has a positive impact on project performance. In this research, HR fit or Degree of Resource Alignment has been conceptualized to include two dimensions – resources closely mapped to the specific technical and domain requirements at the start of the project or 'ERA' to provide efficiency gains, and resources that are multi-skilled and/or more experienced enlisted in the project to provide flexibility in managing the anticipated project level uncertainty (Pich et al, 2002) or "performance risks". This uncertainty or risk is anticipated because of expected high requirement volatility and/or internal/external coordination challenge. The multiskilled flexible dimension of DoRA represents the notion of "flexible" resources as "appropriately fit" resources in cases of uncertainty. It is pertinent to note that both high productivity and low costs and management of the performance risks are critical for the success of outsourced IT projects.

It needs to be emphasized that in this research the dimensions of planned human resource flexibility was conceptualized as a construct distinct from exact resource alignment, as per the conceptualization of distinct 'fit' and 'flexibility' constructs in HRM literature (Wright & Snell, 1998). The EFA (Table 2) convergent- discriminant construct validity test confirmed the distinctive unique nature of ERA and PHRF.However, the EFA tests on DoRA items in the pilot and main studies revealed

single factor implying shared variance between the two dimensions. This shared variance represents some threshold need for HR Flexibility in any project, especially in global delivery model. Thus, even though human resources might be closely mapped to clear specifications, they still are expected to exhibit flexibility even for simple routine project, and vice –versa is also true that flexible experienced resources also contribute to achieve the efficiency goals in the projects. This was verified by respondents who explained that even routine projects are broken down into modules, and to counter concomitant coordination issues, flexibility is required. This flexibility is not so much of the skill form but pertains more to certain adaptable behaviours such as collaborating with other modules, working across different schedules, and stretching.

This research contributes significantly to the mainstream HRM literature by conceptualizing and testing DoRA, thus explicating the intricate dual nature of HRM planning in the context of dynamic/ unpredictable environments. Specifically, exact resource alignment and PHRF respectively represents the notion of 'fit' and 'flexibility' established as independent constructs in HRM literature (e.g., Lengnick-Hall & Lengnick- Hall, 1988; Wright& Snell, 1998). However, this research could explore the distinct nature as well as the relation between the two by identifying the common underlying secondorder latent construct of overall fit or DoRA, and this has not been previously attempted in the HRM research at any level. With respect to flexibility dimension 'PHRF', the research operationalises the notion of 'flexible resources being fit' in dynamic environments (Wright & Snell, 1998). There is support for expanded conceptualization of "HR Fit" hypothesis. By drafting exactly aligned resources and flexible resources project managers build structural ambidexterity (Gibson & Birkinshaw, 2004) in projects. It would be manifested during project execution in ambidextrous behaviors of exact routines followed and skill and behavioral flexibility demonstrated quite independently.Thus the dual features complement additively in influencing PP.

The conceptualization of duality of HR planning is a departure from the extant research in IT project HR planning (Tsai et al., 2003; Otero et al., 2009; Andre et al., 2011; Kang et al., 2011; Silva & Costa, 2013) focused on models optimizing skill, behavioral, and experience profiles with objective

function being minimization of project time and /or cost. The model based approach implicitly assumes that either the project needs can be identified fully apriori and/or the needed resources can be marshaled on just-in – time basis. Both assumptions are questionable as change requests and coordination issues crop up unpredictably and short duration IT projects prefer incorporation of multi -skilled and experienced members right from the early stages to maintain continuity across different phases of a project (Kang et al., 2011), even if it would mean costly skills slack. This conceptualization of duality in HR planning aiming to fulfill both the execution efficiency gains and flexibility to mitigate the negative influence of uncertain risk is one of the major contributions of this research to the project planning literature.

It needs to be emphasized that such provisioning of experience and multi- skilling right from the beginning might not be necessary in many project situations wherein just-in- time drafting of human resources as and when an uncertain need arise would be preferred. Wright & Snell (1998) identified two ways of providing multiskilling- by resources that are individually multiskilled or by resources that are narrowly skilled but sufficiently available in numbers for employing in projects as contractual resources as and when needed. The second option is not desirable in the IT projects because of the scarcity of higher order skills and experience and the constraints on the degree to which new member's cangel in with the team at later stage in the projects (Kang et al., 2011). It was also verified by the respondents of the study in the interactions with the researchers during the data collection stage.

11.2 Impact of Executed HR Flexibility on Project Performance

While provision of HR flexibility at the project planning stage is critical, executed HR Flexibility denotes the actual response to the unpredictable challenges that crop updуring the execution stage of the project (Wright & Snell, 1998). The provisioning of HR flexibility potentiates the flexibility behaviours. However, only capability is not enough for eliciting flexibility behaviour but willingness of human resources to execute such behaviours is also necessary (MacDuffie, 1995). Flexible HR practices and/ or Flexibility inducing HR practices (Ketkar & Sett, 2009; Way, et al., 2015) such as rewarding adaptable

behaviour, and skill based pay are needed to evoke such flexibility. Future research can investigate impact of such policies on evoking flexible behaviours in project teams.

The executed HR flexibility of the team members and its two dimensions- skill and behavioral flexibility, showed direct positive influence on project performance. The first dimension corresponds to the multi-skilled contribution during project execution and the second corresponds to the adaptable behaviours including work stretching and learning new skills during the project execution. Executed HR flexibility mediated the influence of a-priori built flexibility potential or PHRF (fig 1). During project planning, to build flexibility the focus remains on the broad base of technical skills and domain experience rather than on more subjective adaptable behaviours. Project Manager is able to capture information on skills unambiguously and accordingly deploy multi-skilled resources. However there exists evidence that skill flexibility does facilitate behavioral flexibility (Wright & Snell, 1998; Ketkar & Sett, 2009).

The primary reason why HR flexibility is deliberately built in at the planning stage is to counter the performance risks posed by requirement volatility and coordination issues later on. The moderating effect of executed HR flexibility in mitigating the negative influence of both requirement volatility and coordination challenges on PP was evident only for Skill flexibility dimension. These performance risks are exogenous and fairly unpredictable to the project management and need an endogenous response that neutralizes their negative effects on the project performance. The skill and experience flexibility helps in quickly and effectively protecting project from the downside performance risk emanating from the unforeseen requirements. The moderating effect of SF on PP was comparable to the direct effect of skill flexibility, highlighting the important role that EHRF plays in managing key source of performance risk in IT projects.

11.3 Role of HR Flexibility in managing Internal and External Uncertainty Challenges

Requirement volatility and client driven coordination challenges have a direct negative impact on project performance as these result in both cost and time overrun for a software project. MVA shows that the

negative influences on project performance of client driven requirement changes and coordination issues are greater than the internal team issues (Table 5). Though, it needs to be emphasized that many times the trigger for internal coordination issues is rooted in the frequent changes originating at the client end.

Further, the correlation values revealthat while execution HRF negatively influenced the team related coordination challenge (σ = -.20, $p < 0.05$), it had little direct influence on client driven requirement volatility (σ= -.07) and coordination challenge (σ = -.04). These results are understandable because client driven challenges are largely exogenous to the project planning and execution. Thus, HRF cannot reduce the externally driven challenge but can provide a potent response to mitigate the negative effects on PP, as is evident from the moderating effect results for Skill flexibility. However, EHRF of both skill and behavioral kind would directly reduce the generation of internal team coordination problems, like inter-module coordination and sharing of resources, but would not reduce other internal team uncertainties like attrition. Additionally EHRF, atleast as demonstrated for SF, does check the team related coordination issues.

12.0 Limitations and Future Directions

The study used significantly modified and newly developed scales and these scales exhibited only modest statistical properties. While for an exploratory study such as this, it is acceptable to use such scales, it also implies that these scales need to be further tested and modified. Second issue is related to the common method bias that might have crept in, though we ruled out any significant impact. Thirdly we have used retrospective data for the study. The responses might have been influenced by the ultimate success or failure of the projects. Future research can further test interactive complementarity between HR fit and flexibility and establish the existence of contextual ambidexterity (Gibson & Birkinshaw, 2004) in influencing PP. This research direction can be further extended by undertaking multilevel studies at the firm and project levels so that a more comprehensive conception of HR fit (including horizontal fit) and HR flexibility can be studied simultaneously for their impact on PP.

13.0 Conclusion

This study contributes to the IT project management human resource allocation theory by proposing and demonstrating that a dual- dynamic model of HR fit and flexibility and not just static fit model would be needed to manage the dynamic performance risks for better PP. IT projects are relatively shorter in duration, follow global distributed model, cater mainly to global clients, face internal and external uncertainties, and are knowledge centric. Therefore, the role of human resource planning bringing in appropriate degree of skill and behavioral flexibilities is very critical for the project success. Further, this incorporation of appropriate HR competencies has to be done at the beginning, even providing for costly slack, as later on it is difficult to bring in such resources from outside into the project on immediate basis due to zero lead times and non- availability of such resources. This is particularly important in the IT project based organizations (PBO)that are predominantly dependent on the higher end knowledge and skills of their employees for project success, and wherein the projects face fair degree of uncertainties and dynamism leading to grave performance risks. In such cases, the project planners can adopt duality in the project planning aiming to achieving anoptimal mix of exactly aligned specific skills and broad based multiple skills and experience to manage risks. In such project contexts, the PBOs also need to encourage behavioral flexibility like openness to quick relearning by selecting and rewarding employees for such attributes. Thus this study provides important insights for the industry practitioners as well.

This study contributes to the main stream HRM literature on the role of HR fit and flexibility in enhancing project performance, a context neglected in the mainstream literature. The study makes contribution in conceptualizing the HR fit construct of Degree of Resource Alignment that extends the notion of fit to include “flexible resources as fit” in case of such requirements in certain projects. In this study, a distinction has been made between HR flexibility as a potential capability and execution HR flexibility. While DoRA construct includes HRF potential at time t=0, execution HRF represents the actual multi-skilled and adaptable behaviours during project implementation. It needs to be emphasized that both dimensions are flexible behaviours – one potentiated by multi-skilled resources and the other constituting adaptable behaviour such as stretching, learning and so on. This is another unique

contribution of the study, as it explicitly included time dimension in separating out and defining various flexibility components. This is especially relevant at the project level of analysis as resource estimation and planning and project implementation management are both critical processes.

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Type of Project	Life Cycle model used (Number of projects)			Pricing Model used (Number of projects)			Avg. Effort (In person months)
	Waterfall	Agile	Others (Spiraletc.)	Fixed Price	Time & Material	Mixed	
Maintenance	17	9	30	12	42	2	397
Development	37	2	37	76	0	0	407
Testing	21	0	0	0	21	0	411
Combination	21	15	5	39	0	2	400

Table 1: Project distribution in the sample

Items	Components					
	1	2	3	4	5	6
Exact Resource Alignment (ERA)						
During initial allocation of resources to project, I accurately got the technology skill set required.		.811				
During initial allocation of resources to project, I accurately got the domain knowledge required.		.788				.269
The human resources at the start of the project were exactly what the project requirements demanded.		.854				
Most of the project requirements could be directly mapped to the human resources deployed on them.		.649				
Planned Human resource Flexibility (PHRF)						
At the start of the project, most human resources deployed by me had a wide array of skill.		.352	.544			.315

My team had resources that could work, if need be, on multiple modules within the project.		.395	.631			
Requirement Volatility						
There were additions and deletions in the requirements after the start of project implementation.	.742					
Modifications to the project requirements made them very different from the initial requirements.	.787					
Requirements kept changing throughout the implementation of the project.	.892					
Scope Creep (Change in project's scope after the implementation started) was a frequent problem during project implementation.	.885					
There was considerable change from the client's side in the requirements after they had been defined.	.828					
Team Coordination Challenges						
Coordinating resources across different locations was a challenge.				.802		
Changes in the team composition (such as attrition, resource sharing etc.) made coordination difficult.				.733		.273
Client Coordination Challenges						
Dynamic requirements needed more effort required (in person-hours) in the project.	.502				.292	.355
Loss of client commitment and cooperation during the project posed challenges for us.	.542					.653
Communication overhead was high due to the client's side.	.393			.270		.751
Executed Skill Flexibility						
Some resources under me worked in different roles due to their broad skill set, as and when required.			.781			
Most resources under me could perform equally well, in terms of skills, at both onsite and offshore, during the implementation of the project.			.742			
Executed Behavioral Flexibility						
The flexibility of the team members' work habits/norms helped us to cope with the uncertainties during project implementation.					.802	
Resources, under me, were always willing to stretch in terms of time, as and when need arose.					.803	
During implementation of the project, team members learnt new skills in the training sessions which were required for the project.				-.427	.311	.338

Table 2: Results of factor analysis for project planning & execution variables

Items	1
The project under consideration was completed on time.	.798
The project under consideration was completed within the estimated budget.	.803
All SLAs initially agreed upon with the client, were met in the project.	.800
The project met the quality standards (defect rate related).	.829
The application was produced to all specifications.	.830

The application/product met all the requirements of the clients.	.836
The client was satisfied with the project implementation.	.862
Based on the project performance, the client wants to maintain long term relationship with my company.	.800
The project contributed to my company's systems, processes and structure.	.518
Client expectations were met at every milestone during the project implementation.	.824

Table 3: Results of factor analysis for Project Performance variable

	Variables	Mean	S.D.	1	2	3	4	5	6	7	8	9
1	Project Complexity	6.35	1.5	-								
2	Project Management	5.87	1.68	.082	-							
3	Deg. of resource alignment	4.32	1.02	.018	.086	0.81						
4	Exact resource alignment	4.09	1.25	.016	.071	.87**	0.82					
5	Planned Human resource flexibility	4.55	1.14	.015	.076	.84**	.466**	0.63				
6	Requirement Volatility	4.42	1.32	.048	-.054	-.116	-.148*	-.046	0.9			
7	Coordination Challenge	4.34	1.16	.044	-.020	-.146*	-.207**	-.035	.547**	0.75		
8	Executed HR Flexibility	5.12	0.86	-.017	-.017	.428**	.249**	.496**	-.067	-.154*	0.61	
9	Project Performance	5.6	0.94	.085	.074	.293**	.28**	.219**	-.326**	-.294**	.288**	0.93

N = 189; Scale reliabilities (Cronbach Alphas) are along the diagonal

***p<0.01; *p<0.05*

Table 4: Descriptives: Means, Standard Deviations, and Bivariate Correlations

Independent Variables	Effect of Human Resource Planning		Effect of HR Flexibility & Performance Risk factors during execution	
Project Complexity	0.077	0.077	0.102	0.099

Project Management	0.043	0.043	0.054	0.06
Degree of resource alignment	0.29**	-	-	-
Planned HRF	-	0.11	-	-
Exact resource alignment	-	0.22**	-	-
Requirement Volatility (RV)	-	-	-0.24**	-0.21**
Coordination Challenge (CC)	-	-	-0.127	-
Client coordination challenge	-	-	-	-0.15*
Team coordination challenge	-	-	-	-0.02
Human Resource Flexibility	-	-	0.255**	-
Skill Flexibility (SF)	-	-	-	0.18**
Behavioral Flexibility	-	-	-	0.15**
Adj R^2	0.08**	0.077**	0.18**	0.177**

***p<0.05, *P < 0.1; n = 189*

Table 5: PP regressed on Planned and Executed HR factors, and Performance Risk factors

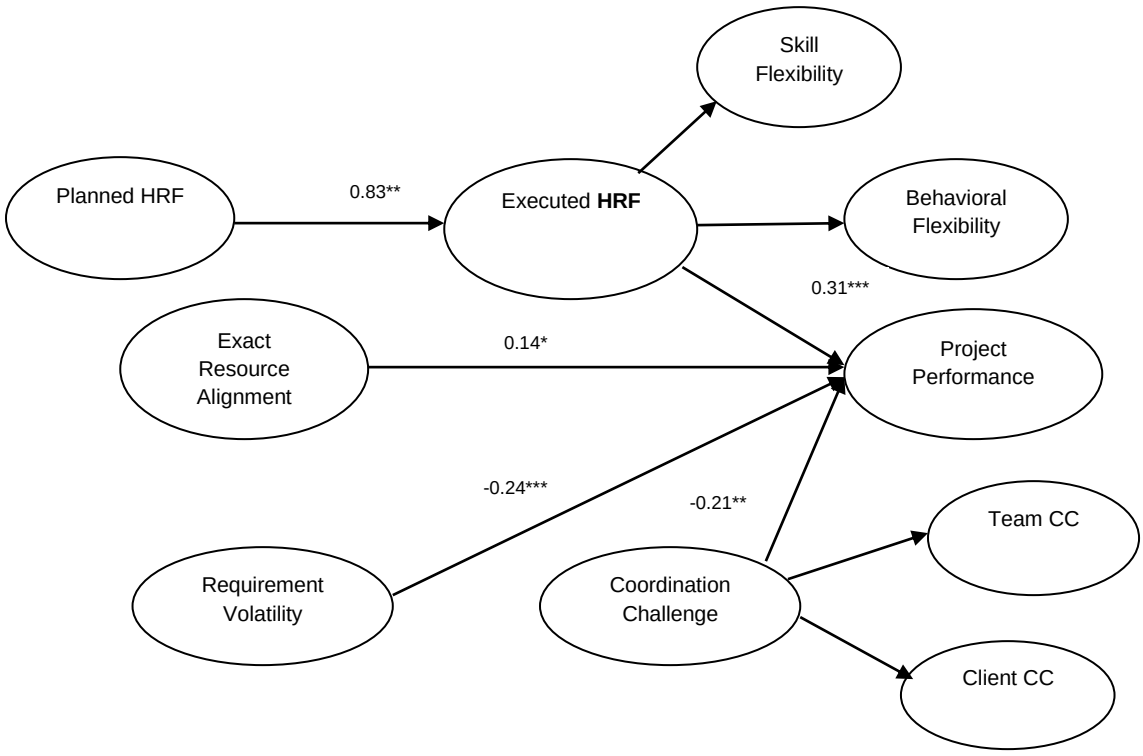

Fig 1: SEM test of hypothesized model *(*P<0.01, **P<0.05,*P<0.1*)**

IndependentVariables	SF X RV		SF X CC	
Project Complexity	0.10	0.12	0.10	0.09
Project Management Capability	0.05	0.007	0.05	0.04
Requirement Volatility (RV)	-0.31**	-0.31**	-	
Coordination Challenge (CC)			-0.27**	-0.28**
Skill Flexibility (SF)	0.234**	0.223**	0.213**	0.21**
SF X RV	-	0.15**		-
SF X CC	-	-	-	0.14**
ΔAdj R^2	0.155**	0.172**	0.126**	0.141**

***p<0.05; *p<0.1; n = 189*

Table 6: Test of moderation effect of SF on RV-PP and CC- PP relation