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Emerging Technologies and Emergent Workplaces: Findings from an Ethnographic study at an Indian I.T Organization

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Abstract. Over the past four decades, Indian Information Technology (IT) industry has been delivering traditional software and BPM (Business Process Management) services to its clients across the globe. Providing cost-optimized, yet high-quality services following standard process methodologies has made it an attractive destination to clients across industry verticals. Today, the challenge before this industry is to provide emerging technology solutions to clients in their digital transformation drive. Situated at this pivotal juncture in its journey, the ‘work from home’ (WFH) norm during to the recent COVID-19 pandemic posits challenges of a new kind for this sector. We explore these challenges based on our four-month ethnographic study (Jan-May, 2020) in a service-based IT organization situated in Bengaluru, which over the past five years has been developing Artificial Intelligence (AI) based solutions to its clients.

Keywords: Work from Home, Artificial Intelligence, Indian IT industry.

1 Introduction

Indian Information Technology (IT) Industry has now had over a four-decade history of providing software and business process outsourcing/management (BPO/M) services to its clients across the globe. It has moved from providing labour arbitrage driven simple software coding and BPO services, to providing high-end custom software and BPM services [1-3]. Providing cost optimized, yet high quality software and BPM services, following standard process methodologies has made Indian IT an attractive destination to clients across industry verticals [3]. The challenge before this industry today is to provide emerging technology solutions around Artificial Intelligence (AI), Big Data, Cloud and IoT, to clients in their digital transformation drive. While developing new technology solutions that build on existing standard process workflows may be smooth, the challenge is to integrate solutions around technologies such as AI which require an overhaul of process workflows [4-5].

Situated at this pivotal juncture in its journey, the ‘work from home’ (WFH) norm during to the recent COVID-19 pandemic posits challenges of a new kind for this sector. Though the usual software services and emerging technology projects continued to be served with employees working from home [6], visible concerns around security and

infrastructure limitations made it harder for Indian IT/BPM firms to facilitate their employees working from home [7]. In our study we attempt to understand the impact of WFH as it was unfolding in an AI based project in an Indian IT organisation. We were involved in an ethnographic study in a service-based IT organization situated in Bengaluru, which has been developing and delivering customized software solutions over the past 25 years and for the past 5 years has started delivering AI based projects to its long-standing clients. As a part of this ethnographic study, during the months Jan-May, 2020, one of us worked as an intern in this organization and was a member of a running AI project team. Because of the nation-wide lock-down due to pandemic in March 2020, the researcher worked for 3 months in office and a month at home. Serendipitously, we were thus able to observe the nature of work interactions between employees both in office and while working on the project from home. Our research method, which is to carry out ethnographies at workplaces, is motivated by the works of Barley and Kunda [8-9]. Our findings suggested that while the organization's efforts in streamlining workflows for AI project are still a work in progress and fraught with challenges, these challenges have further deepened because of a transition to WFH during this pandemic. We illustrate this gap by deep diving into the nature of interaction between work roles in a typical AI project carried out in office and how it changed during work from home.

2. Emerging Technologies Indian IT and WFH

2.1. Emerging Technologies and Indian IT sector

A major portion of Indian IT industry is constituted by organizations that cater to custom software and BPO/M services. As of the year 2016, these services together contributed to around 49% of the total service exports from the country, to over 7% of the country's GDP, and constituted over 70% of the offerings from this industry in total [10]. Prior to the year 2000, Indian IT was mainly known for providing simple software programming services relying on its vast pool of engineers, with limited scope for technical innovation or managerial contributions [1]. The key driver during this time was the reengineering movement of the 90s which necessitated a standardization of work processes and practices around software development and business process outsourcing so that the work can be distributed across the globe [2]. This service globalization facilitated Indian IT companies to provide customized software and BPO services that were mainly driven by labour or cost arbitrage deals [1-3]. Further global standard software platforms reduced the reliance on firm-specific investments, as individuals anywhere from the globe could now cater to the business requirements provided they have the necessary skills to work on such platforms [2]. This implied a vast manpower availability, in the form of engineering workforce, enabled the Indian IT industry to quickly reap the benefits from this global changes in service industry [1-2]. Not only did Indian IT helped global enterprises with skilled manpower at low cost, but they also ensured quality of software and service delivery. Majority of the global

IT companies that registered highest levels in their maturity of software development processes were from India [3-11].

Today, both the IT and BPM segments of the industry have to gear up to provide emerging technology solutions to its clients around Artificial Intelligence (AI) and Cloud. Immense amount of data is being generated within organizations across industry verticals, and the social world, at an unprecedented rate in terms of its volume, variety, velocity and veracity constituting what is often termed as the 'Big Data' [12]. Analysing such Big Data will rely on cloud services to manage the data storage and service requirements [13], and AI based solutions can generate actionable insights from such data for organizational decision makers [12, 14]. Adoption of these new technologies enhance the competitive advantage of firms [15], through improvements in their supply chains [16], by enabling swift responses to prospective business opportunities [17], enhancing the likelihood to produce new products and services in comparison to their peers [18], and therefore improve their overall performance [17]. Driven by these factors clients are driven to adopt emerging technology solutions and for which they are again looking towards their long-standing service providers – the Indian IT [19]. While Indian IT traditionally catered to a majority of clients from industry verticals like manufacturing, telecom, banking and finance, driven by digital transformation goals around emerging technologies new verticals like retail and healthcare are getting added to this list [10]. The need for delivering emerging technology solutions to clients is necessitating organizations within Indian IT to incorporate new work roles, and form new teams to develop in-house capabilities around such technologies. These teams are now comprised of diverse work roles spanning both traditional and emerging technologies such as data scientists, data/cloud/software engineers, cloud/software architects, and also including traditional project management roles such as business analysts, and project managers [10, 20]. It is now imperative for Indian IT organizations working on integrated software and emerging technology projects, to facilitate a seamless collaboration across such a diversity of work roles.

2.2. Work from Home

With the COVID-19 pandemic shifting the office work to home, a slew of changes are expected in the manner in which work might be carried out in future if the situation persists over a longer period of time. It is expected that the usage of digital platforms and the demand for expert workforce in technologies such as Cloud might increase, while the need for commute and office space may come down. Further, in the long term, working from home may also lead to detrimental effects on work-life balance of employees, when the convenience of working from home gives rise to some sort of 'permanently-at-work' culture [21]. In addition to these expected changes, literature also discusses about the ways in which digital work can alter the forms of leadership and work autonomy [22], how they can blur the boundaries between public and private spheres of life [23]. Increased digital work can also result in 'techno stress' [24], reduce employee autonomy [25] and therefore it is important that organizations carefully balance all these positives and negatives of WFH [26].

While these impacts of WFH are discussed in the context of organizations in general, we intend to understand the concrete implications of WFH in Indian IT service-based organizations that are currently transitioning towards providing emerging technology solutions, in particular around AI. It is widely acknowledged that a move towards providing AI solutions, that require building machine learning (ML) models, requires a rather revolutionary adjustment of existing traditional software work processes [4, 27]. The absence of strict abstraction boundaries between different ML work components [4, 27], forecloses the possibility of modular development [4], warranting a constant iterative interactions between work-roles handling different stages of the ML workflow [4, 5, 27]. In contrast to AI solution development, the key tenets of traditional software development are that it is modular, and allows for customizability and reuse of software programs or modules [4, 28]. These tenets enable clear division of tasks between various work roles in different stages of an SDLC, i.e., software development life cycle [29–31]. Our ethnography provided us an opportunity to observe the WFH related challenges facing an AI team within this service-based IT organization, who have been attempting to work around the traditional standardized software development processes while working for an AI project.

3. Research Context and Methodology

3.1. Empirical Context

Our empirical context is a service-based organization based in Bengaluru, India, providing IT-BPM services to its clients across the globe for over 25 years. In addition to traditional software and BPM services, this organization in the past few years has been actively responding to the emerging technology needs of its clients. By gathering members from traditional software teams and recruiting employees for new roles, this organization has formed an in-house team specifically for this purpose. This team, which we call AI team, has been developing customized AI solutions for clients seeking business process automation, and in the process accumulated several proprietary AI solutions (IPs) over the past 5 years. Solution stack constituted by such IPs has enabled this organization to not only offer turnkey services around AI for its future clients, but also to deploy them over cloud platforms such as AWS (Amazon Web Services), Azure and GCP (Google Cloud Platform) allowing their generic usage in the online marketplace. While client centric projects formed the major source of building IPs (for eventual customization and reuse), research projects related to AI utilizing off-the-shelf data is another source. Since our research objective was to understand the changing nature of work and mobility in the Indian IT industry, working as a resource in a project was beneficial over formal interviews or questionnaires, because it allowed us to understand the situated work-practices as they unfolded. Taking into account our research objectives, and the researcher's prior qualifications (industry experience, and knowledge of machine learning from doctoral coursework) the head of the team assigned three tasks to the intern while he/she worked in this team. (1) to work as a full-

time resource in a running Natural Language Processing (NLP) based project, (2) to understand, identify and document a common workflow based on the team members' experience of working across multiple projects over the past 5 years, and (3) to periodically report our research findings to members from the team. The first two tasks were considered as a value-addition that the researcher would bring to the team, and the last task was to help researcher triangulate and validate his/her findings. These assigned tasks allowed researcher to become a usual member of the team.

3.2. Ethnography at workplace

According to Barley [9], study of work in organizational theory has gone into the background, and many studies either simply acknowledge the complexity of work or just gloss over the 'issue of how work might be changing'. However, according to him, pushing the complexities of work into the background while studying organization is not of much help in understanding organizational change. Because, "when nature of work in an organisation changes because of new technologies, or markets - organisational structures have to adapt or risk becoming misaligned with the activities they organise." [8]. It is therefore argued that bringing work back into organizational studies is imperative especially in today's context where technologies are rapidly evolving and markets are constantly expanding, affecting organizations both from within and from outside. Our method of research was ethnography at a workplace motivated by these works of Barley and Kunda [8, 9]. According to them, ethnographic research that engages closely with work practices, allows researchers to provide 'in-situ' explanations about the complexities of work and how they impact organizational responses to changes happening in the environment around. While providing a rich 'emic' perspective or the 'native point of view' about the day-to-day work and work interactions, it also motivates the researcher to simultaneously relate it with the 'etic' concepts which are the 'analytic constructs removed from the native point of view' [8]. It also provides a possibility to understand the deeper causes of organizational change with changing nature of work [8, 9]. Further in the context of work roles within organizations, by studying situated and actual roles rather than ideal-typical ones, researchers can have a more nuanced understanding of these roles, both in their relational and non-relational aspects.

3.3. Data

Working with team members in a project, joining them for breakfast, lunch, and coffee, engaging in impromptu conversations near cubicles, attending team meetings, knowledge transfer sessions, birthday celebrations, employee farewells, and many more events laid the basis for the researcher building a strong rapport with the team members. Further, the assigned task of conducting unstructured interviews with some of the team members to understand the project work flows, allowed the researchers to get a concrete sense of the overarching work processes within the organizational structure. Since the researcher had also worked from home for over a month, he/she

was able to document the nature of interactions between different work roles that happened in the context of an AI project. The contrasting observations between work interactions at office and from home, in the context of this project was the prime motivation to carry out this particular study. Observations during interactions at work (either in office or from home), unstructured interviews, and impromptu conversations, allowed the researcher to not only internalize his experiences from the field, but also document them in rich detail on a daily basis in the field notes. This field notes were constantly shared between the two researchers, which motivated numerous discussions and reflections which guided our overall research. Our ethnographic field notes ran into over 100 single-spaced pages that amounted to over 75000 words. In total the ethnographer closely interacted with around 24 team members with their experience in this industry ranging from 6 months to over 15 years. These members occupy work roles such as data engineers, business analysts, managers, data scientists, software engineers, technical architects, and team lead.

4. Findings – AI Projects and Work Interactions

A majority of the AI projects taken up by this team were for the long-standing clients of this organization. Having established itself as a major service provider of IT-BPM services to its clients over two decades, it has recently ventured into providing emerging technology solutions. Standard work processes around custom software maintenance and BPM services ensured this organization to maintain quality while delivering cost optimized solutions. As a continuation of this client-service provider relationship, most of the long-standing clients of this organization now expect it to also provide AI based solutions. However, given the organizational structure built around traditional software and BPM, a majority of the projects were of an integrated nature, predominantly AI integrated on top of traditional BPO or custom software services. Nevertheless, in the process of working on AI projects for clients over the past 5 years, the AI team within this organization also managed to develop standalone IP cores related to AI, with the intention of enabling reuse for future projects.

4.1. Typical project workflow

One of the researcher's assigned task of documenting project workflows, enabled us to observe an important aspect of AI projects within this organization – the continued dominance of traditional software work processes. The project proposal meetings often revealed that there were inherent assumptions about customizability and reuse of AI project components previously developed. During the team meetings, those in project management roles like the business analysts, and managers, usually presented high-level architectural diagrams that assumed some sort of modularity in AI project components. During their initial stages, many of these projects involved constant back and forth interaction between clients, and project managers and data scientists from this organization to enable AI use-case identification. However, after these initial rounds,

when data engineers take up the execution tasks, status of work was often evaluated through agile status meetings. An experienced senior manager in this regard said that, *'in service-based companies where research wings on AI are setup, they often tend to follow traditional software kind of methodologies.'* Since the organization has to make trade-offs between accuracy and resource usage in these projects, we find the Team Lead and Project Managers pushing for maximum reuse of existing project components. Data-scientists are typically considered costly resources, and as a result they are often engaged only during the initial stages of the project or while eventual signing-off of the work done by data engineers. In an ideal scenario, the two major work components, i.e., data pre-processing and model development need to be worked out in tandem for a given use case [4, 27]. But what we noticed in typical AI projects here, was a clear separation of tasks between data engineers who work predominantly on the pre-processing components, and data scientists who work independently on the model development tasks. Data scientists are more involved in the work of IP development from the client's business use-cases. As a result, they pick up off-the-shelf data sets relevant to similar use-cases and build standalone machine learning (ML) models as IPs to be reused in future projects. Data engineers on the other hand, encountering a changing volume and variety of data from the clients during the time of project execution, are constantly involved in sharpening the pre-processing programs for feature data-extraction. Insofar as model development is concerned, they often end up feeding their extracted data to the standalone IPs that have already been developed by the data scientists, which would now be a part of the solution stack of this team. While this strategy could result in an accuracy drop [4, 27], the 'project managers' (business analysts and managers) find it a better option because given the manual validation by BPO workforce to fill the gaps, it saves costs.

4.2. Project execution and work interactions in office

The ethnographer worked with two data engineers, business analyst, and a senior manager, during the project execution phase, where he/she worked closely with the two data engineers and their work together was periodically overseen by a senior manager and a business analyst. Weekly status meetings were therefore organized between the data engineers and the business analyst and/or project manager in order to evaluate the progress. Since the project was ultimately headed by the team lead, a monthly status meeting used to be conducted where the team lead evaluated the overall progress of the project and the work done by each of the data engineers. This project like standard AI projects involve pre-processing data, model-building, training, and deployment which ideally needs constant collaborative efforts across different work roles [4]. However, we observe a separation of tasks and very little formal collaboration between work roles in this team. At the start of the project, the data engineers' task was to build on existing pre-processing programs taken from previous projects and try to see if they can be reused for the given client use-case. It was too early in the project execution phase and the volume and variety of client data was so low that it was hard for the data engineers to even think of model building. Model building needs data that is representative of the

observations related to client's business use-case – and therefore it calls for ample volume/sample size, and enough variety. Despite not having a chance to build models, the data engineers used to have informal discussions with the data scientists about the appropriate model building strategy and the fit of the existing IPs to be used in the future, for this project.

In office, such discussions happened at the convenience of the data-scientists who sat very close to our cubicles. Data-scientists, involved with IP development for the organisation, often are part of the proposal/project initiation phases of upcoming projects, and work towards streamlining AI workflows. It is not easy to get their time. Their skype (formal chat platform for employees) status used to be one of 'do-not-disturb', 'busy' or, 'in-a-meeting' all the time. To give an instance, for the very first meeting around a better way to start executing the current AI project, the researcher and the two data engineers caught the data scientist during lunch and talked to him about the project. We also asked him for his free time when we could have a discussion about this. Since he was busy, he called sometime later in the evening and explained on a white-board in a discussion room about how he developed ML models around similar use-case for a previous project that is now an IP. After an hour, he quickly realized that there is another meeting that he was required to attend, and left abruptly. But over the next couple of days, the data engineers were still able to ask him their doubts and get clarifications, whenever they found him free in his office.

However, the interaction between data engineers and business analysts/senior managers was slightly different. Their task was to oversee the data engineers' utilization and project status and these meetings were more formal and happened on a weekly basis. During these meetings each of the data engineers present the status of their work, and what they intend to do in future. A formal meeting with team lead that happened on a monthly basis also proceeded along similar lines, only that the team lead interacted mostly with the project managers, who in turn questioned the data engineers about the progress. Following quotes from our field notes summarize the kind of interactions that happened during these meetings.

Data Engineers (DE) reporting status to Business Analyst (BA)/Project Manager (PM): *"We tried this out, we worked on this with the help of another person [software engineer] in the team. There are some problems that we are facing. We will ask any data scientist in the team and finalize the way to go for this problem."*

BA reply to the DEs: *"BA seems to be guiding the implementation based on his experience from previous project. He is directing the Data Engineers for building plans for themselves and work. During the meeting he made statements like we need to identify, we need to do this, don't do everything at once, take up one task after the other, try a script or hand-based rules for this problem, you guys refer to what we did in our previous project, look at the files that were prepared."*

PM reply to the DEs: *"If you are finding that this problem is taking too long time and needs extra hands, you can take help from any data engineer or check with any data scientist whenever he/she is free. In the previous project we did it like this. In your whiteboard discussion with data scientist he would have explained you some 3-4 approaches. Take 1 or 2 and try them out and see if they work."*

Not only with respect to their own projects, but the overall work in office allowed these data engineers to gain knowledge from their team mates about other projects and also about other kind of work beyond AI, such as integrating AI modules into existing softwares and their deployment in the cloud. The researcher was part of many such informal discussions these data engineers had with their lunch mates who were also their college friends. Conversations between them always started with a common question, ‘what are you currently working on?’, that is posed on a daily basis. Unknowingly, in these conversations, a good amount of talk about happenings in their organization, knowledge of the projects they are working on, and the projects others were working on, got passed around. From the field notes, we were thus able to intuit these informal channels through which ‘tacit’ knowledge got accumulated within an organization.

Lastly, the researcher noticed that the data engineers usually worked together to complement each other’s work when in office. We noticed that one of them was good at programming, while the other was reluctant to spend time on programming and instead was more interested in the model building component of their project. Anything related to the project they used to engage in it together. The one who was less interested in programming used to consciously find ways to engage with data scientists. He used to take his fellow mate and approach data scientists whenever he found them free and used to engage in informal discussions about existing ML strategies for different projects. He also used to ask business analysts to involve him in the meetings with clients so that he could understand the business use case better. The other person who was good at programming used to similarly approach software/cloud engineers and architects for getting clarifications about best ways to build their pre-processing programs, to gain a general understanding of how the software/cloud engineers usually integrate AI modules on custom software and how they deploy it in the cloud, and so on. Since both of them mostly worked together, despite one person’s initiative, both the team members used to benefit from such interactions.

To summarise, we noticed that, the overarching work processes in this organisation, which are heavily oriented towards traditional software development have provided very few formal avenues for data engineers to gain understanding beyond their data pre-processing work. However, we observe that in the office spaces, informal interactions with their seniors afforded them a possibility for gaining such understanding. For example, they were able to approach data scientists about ML model building, cloud architects about model deployment in cloud and business analysts about the nature of client interactions, informally. This was less likely within the formal project setup that was largely dominated by the regular project meetings between data engineers and those executing the project in the organisation.

4.3. Project meetings during WFH

“Less or no scope for informal knowledge sharing like in office. Every call becomes a client call where one reports status and other evaluates status. Persuading

supervisors through effective communications becomes most important.” – Reflections from attending project status meetings online, Field Notes

During the lock down period when employees of this team were asked to work from home, the dynamics of interaction between team members working on this AI project had changed. The formal status meetings with project managers and the team happened online, but still followed a similar style of interactions. But the data engineers now lost all those informal pathways to gain situated knowledge from experienced technical experts and business analysts which used to be possible while in office.

“WFH demands that individuals spend a lot more time before having to present anything in a meeting. A lot more work needs to be done in preparing the presentation so that it can be shared, read out and articulated properly so that the others could understand. Further it happened that the two data engineers were asked to present their respective works, and it became difficult for them to segregate and present. While in the meeting room last time they were able to take turns and jointly present, here it was a bit difficult for them to do that, so they divided the same presentation between the two and presented.” - Reflections from attending project status meetings online, Field Notes

Another conspicuous observation we could identify based on the online project status meetings was the mode of communication. We noticed that the two data engineers who used to work together while preparing their status presentations in office, failed to do that when the meetings shifted online. Each one of them independently prepared very detailed presentations indicating their share of work done in the project. Hitherto in office, especially during the status meetings with the business analysts and managers, we noticed that the two data engineers used to go onto the board intermittently while presenting their progress of work in the project. Sometimes when their presentations weren't ready, they used to present their status on the board, extempore. However, with work from home, we noticed that in every weekly status meeting and the monthly meeting, they came with detailed presentations describing what they have done over that particular week or month and what will they do in future.

We also noticed that clarity of presentation is very important during these online meetings. For example, the two data engineers during their presentations in office were able to complement each other while presenting, since they worked on it or at least discussed with each other in office. However, during online meeting we noticed that this did not happen. Since each of them prepared their presentations independently and didn't get a chance to informally discuss, like they would have done in office, we noticed that while one of them was presenting the other was silent.

5. Discussion and Conclusion

Our situated description of project work flows at the organizational level indicate that there is a clear separation of tasks between data scientists and the data engineers, which is not ideal while developing an AI project [4, 27]. Further, based on the interaction between work roles during the regular project status meetings, we observe

that the traditional project managers continue to push for customization and reuse of prior project components. As a result, in this organisation, AI projects are still being carried through the traditional software workflows and processes. Building workflows suiting AI projects, which allow for constant back and forth collaboration between work roles, is still a work in progress. We observed that data scientists who are engaged in developing standalone AI related IPs, were also actively trying to promote workflow changes suiting the requirements of AI projects. Data Engineers on the other hand are making efforts to go beyond the task separation envisaged within traditional software methodologies, and collaborate with other work roles. Office spaces provided them avenues for having informal interactions with data scientists which enabled them to reflect about ML model building while working on their usual pre-processing tasks. However, during WFH, data engineers were unable to gain this situated understanding of ML model development. On the other hand, the influence of traditional software project management continued undeterred even when project meetings shifted online. Figure-1 illustrates the interaction between work roles and changes during WFH diagrammatically.

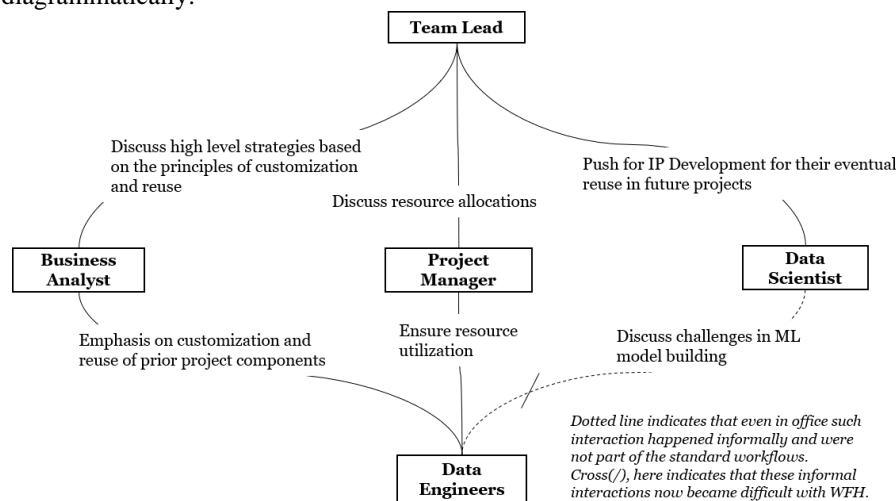


Figure 1: Work Interactions during AI project

From our ethnographic findings and discussion, it is clear that this IT based organization, is largely embedded in traditional software work processes, despite its avowed move towards delivering AI based projects. However, we surmise that the lack of formal AI workflows was actually being made good, tacitly, through informal interactions among its employees. In the absence of a well laid out AI structure, the beginning of what goes in the name of ‘tacit’ AI structure was being actualized in this organization. To that end, the Organization had done the right thing in having a nascent ‘AI team’, irrespective of work domains, where all employees working on such AI projects sat and worked together. This is bound to change with the shift towards WFH, as replicating such tacit structures online is a challenge facing this organization. While for established MNCs, that specialize in emerging technologies, and provide

platformised AI products to the industry, transition to WFH might not be that difficult. However, for Indian IT industry which is newly venturing into these emerging technologies, we find that the extant organizational workflows and processes are posing unique challenges that needs attention.

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