The Role of Managers in Stimulating Engineers' Intrapreneurial Capabilities - A Case Study of Technology-based SMEs

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Intrapreneurship provides a strategic route for many organizations to achieve growth, keep up with changing trends and improve business performance. Today's technology-based firms face a lot of pressure to innovate, meet increasing customer demands, and build a competitive advantage to survive and sustain successfully in a volatile economic environment. In this context, these firms are seeking to be more intrapreneurial in nature by unleashing the intrapreneurial capabilities of their employees. Technology-based Small Medium Enterprises (SMEs), in particular, have certain limitations in comparison to large organizations in terms of resources and innovation capabilities. These, therefore, impose more pressures among SMEs to utilize their resources more efficiently. This involves stimulating and tapping into their engineers' intrapreneurial potential. In such SMEs, managers play a significant role in facilitating intrapreneurship and empowering and supporting engineers to act as intrapreneurs. There is, however, a scarcity of research on the management support for engineers in such SMEs. This paper addresses this gap using qualitative case study research. Two technology-based SMEs were selected in the UK that are engineering intensive and have successful reputations for introducing innovative products and solutions over the years. This exploratory study investigates how managers in technology-based SMEs encourage, promote, and motivate engineers to contribute towards intrapreneurship and facilitate their intrapreneurial initiatives. The results from these case studies revealed that managers play a significant role in empowering engineers to actively engage with intrapreneurship. They influence an intrapreneurial culture through open communication with their engineers and being receptive to their ideas. They provide continuous support throughout the innovation process, starting from idea generation to execution and planning. They facilitate a culture conducive to intrapreneurship that ensures freedom and flexibility to engineers with their roles and rewards their innovation efforts. Moreover, managers seem to play a crucial part in implementing the business strategy by explaining and clarifying the vision to their engineers and driving them to execute these through their active engagement with intrapreneurship. To successfully drive and sustain an intrapreneurial culture, managers need to provide adequate support so as to keep engineers motivated and engaged with their roles.

Keywords: *intrapreneurship, engineer, technology-based firm, small medium enterprises, management support*

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Introduction

Intrapreneurship involves the exploration of new opportunities and innovative ideas within an organization. It becomes a fundamental element for organizations striving to maintain their market position, obtain a competitive advantage, and achieve superior results in business performance. Authors such as Seshadri and Tripathy (2006) emphasize the role of intrapreneurship to overcome the challenges resulting from globalization, technology change, and competition pressure by unleashing the intrapreneurial capabilities of employees. In the view of Bhatia and Khan (2013), intrapreneurship within an organization is a source of self-renewal, continuous innovation, and the route to attaining a sustainable competitive advantage.

The core of intrapreneurship is to obtain innovation within a company in every aspect that eventually leads to business success (Ping et al. 2010) by pushing current organizational products and services, technologies, norms, orientations, or operations into new directions (Antoncic and Hisrich 2003). Therefore, intrapreneurship provides the foundation and structure where innovation can be encouraged and supported to reach meaningful results.

Many authors focused on the employee as a source of innovative initiatives. Scholars such as Zhao (2005) notes that the essence of intrapreneurial efforts in a firm stems from the innovative actions of employees. They are the main contributor to intrapreneurship who seek to innovate on behalf of the employer regardless of the difficulties they face (Amo 2010). These intrapreneurial activities of employees are fundamental to achieving and sustaining intrapreneurship on the firm level. Hence, the innovation of the firm is related to the extent to which its employees are innovative (Mustafa et al. 2018).

It is the organization that is responsible for creating a supportive environment where employees can thrive and innovate. In this regard, this study considers intrapreneurship as an organization level process related to the practices, strategies, and behaviors by which a firm seeks to innovate, develop new products, technology, services, and foster more initiatives and improvement efforts from its employees. Nowadays, many technology-based firms have developed innovative products, solutions, and services by adopting intrapreneurship as a core strategy within the organization. For example, leading technology-based firms such as Sony, Apple, Google, Ericsson, ORACLE, Facebook, and LinkedIn have successfully enabled intrapreneurship in their business that empowered employees to generate advanced technological products.

Manager's Roles in Stimulating Intrapreneurship and Supporting Employees

Managers at all levels have a crucial role in driving intrapreneurship by enabling employees' intrapreneurial initiatives. They constitute a significant part of intrapreneurship success by leading their subordinates to embrace intrapreneurial activities. They promote intrapreneurship by encouraging and supporting employees and recognizing their innovative efforts (Neessen et al. 2019). According to Moriano et al (2014, p. 104), management support refers to

the "willingness of managers to facilitate and encourage intrapreneurship; including the championing of innovative ideas and providing the resources that employees need to take intrapreneurial actions". For Frederick et al. (2016), management support involves structuring the management in a way that convinces employees to believe that innovation is a mandatory part of their job role. Some of the specific practices and positive attitudes that reflect management support are the quick adoption of employee's promising ideas, championing of innovative ideas, recognition of people who bring ideas forward, support for small experimental projects, and providing necessary resources or expertise and financial support (Kuratko et al. 2005, Frederick et al. 2016). Their support is extended along the intrapreneurial process by providing feedback, evaluation, continuous adjustment, and experimentation, thereby facilitating the intrapreneurial process (Bolívar-Ramos et al. 2012). Moreover, managers have a strategic role by creating and implementing business objectives and sharing a common vision and a culture of learning to all employees (Bolívar-Ramos et al. 2012).

The Significance of Engineers Contributing to the Firm's Innovation Success

Various studies have demonstrated that the realization of intrapreneurial activities requires management support that is very important to those employees willing to undertake intrapreneurial activities (Neessen et al. 2019). The top management of the company should focus on not just attaining talented people but also on retaining them by giving them the chance to demonstrate their intrapreneurial abilities (Bhatia and Khan 2013). Innovation has to be supported from top to bottom by organization processes, structures, and a culture that facilitates idea creation and product development.

The intrapreneurial contribution from engineers in an SME is critical to the firm's growth, sustainability, and competitiveness. An engineer's skills and ideas are a great source of technological development in existing companies (Alam et al. 2020). Today the roles of engineers have evolved, and they are expected to go beyond their status quo, such as the usual technical responsibilities. They need to understand the market, commercial aspects of their work, and the customer segments to develop and align their innovation towards the relevant market sector. Menzel et al. (2007) called such engineers the "technology intrapreneurs" who foster innovation and exploit new ideas into commercialized technical products and services. Retaining such engineers in SMEs is vital for their success and survival. As SMEs usually have challenges with limited resources, they can not afford to lose such talented engineers as it will have a more significant negative impact than it will on large firms (Carrier 1996). In technology-based SMEs, it is essential that organizations develop strategies and approaches to facilitate innovation and encourage their employees to challenge, explore, generate, and implement new ideas (Bagheri 2017). Managers have a substantial role in the overall success of intrapreneurship. They could encourage or inhibit intrapreneurship based on how they deal with their employees and whether they are supportive of their employees' initiatives (Bouchard and Basso 2011).

Research Gap

Based on the literature review, it is apparent that engineers' engagement with intrapreneurship in technology-based SMEs is critical for exploring new business opportunities and innovation; therefore, managers should look into developing their engineers' intrapreneurial capabilities. There is a lack of literature on management support for engineers in SMEs for facilitating intrapreneurship. The purpose of this paper is to explore the factors by which managers can support engineers to engage with intrapreneurship effectively. The paper will address the following question:

> How can managers in technology-based SMEs encourage, promote, and motivate engineers to contribute towards intrapreneurship and facilitate their intrapreneurial initiatives?

Methodology

This study is based on qualitative research using a multiple case study approach. The two case studies presented in this paper were purposefully selected as they are technology leaders in the fintech and medical industries that created some of the ground breaking products and solutions in the market. Both companies fit within the SME criteria with less than 250 employees. In addition, they are engineering intensive firms with an intrapreneurial culture where engineers lead, create, and implement innovation.

The case study methodology is appropriate to investigate and explore a contemporary phenomenon in more depth in its real world (Yin 2017). Furthermore, multiple case study allows for cross-case analysis to draw on general patterns and similarities across cases (Eisenhardt 1989). Primary data was collected through semi-structured interviews representing management from different hierarchal levels, including executive and middle management. A sample of engineers was selected from various backgrounds, roles, and work experience to get an in-depth picture of their organizational culture. Participants' information is provided in Table 1. Interviews were conducted online due to COVID restrictions, and each lasted for approximately an hour. The recorded interviews were transcribed then analyzed using Nvivo, which is a qualitative data analysis software program. "Snowball sampling" was applied, in which interviewees were asked to recommend further participants. To build a comprehensive case study, secondary data in the form of internal company information, technology, marketing, and financial information were also utilized from published interviews and company websites.

Semi-structured interviews follow open-ended questions, allowing the researcher to investigate and explore further important topics that emerged during the interviews. An interview guide was developed with reference to the main research focus. Questions for managers revolved around their practices in promoting innovation; how they empower their engineers and engage with them, how they support the creation of an intrapreneurial culture, how they align their

engineers to adopt and execute the firm strategy. Engineers were asked questions focused on how they perceived the management support for their innovation initiative, how they engage and communicate with managers, and what challenges they face when embarking on any innovation project.

As with all research projects, this study has a few limitations. These limitations are inherent in the adopted research design. Qualitative case studies are limited by the sensitivity and integrity of the researcher as they rely heavily on their own instincts and abilities throughout the research (Merriam 2009). Owners and executive managers of organizations may introduce some form of personal bias during interviews and could potentially give a different representation of reality. This may constrain the ability to present and comprehend accurate and informative data. This potential bias may also manifest itself when engineers express their opinions and views about their managers, other team members, and the organization as a whole. Saunders et al. (2016) highlight the "participation bias" that may result from the nature of participants. Perhaps only respondents who are comfortable with their experience might agree to participate, whereas those who refused may have different opinions and perspectives. One of the possible ways to eliminate such limitations is by triangulating data analysis so as to build a comprehensive view of the phenomenon.

To achieve anonymity, interviewees were assigned a specific code, as shown in Table 1. The companies are referred to as C1 and C2.

Table 1. *Information and Reference Code for Participants*

Company Code	Company information	Participant Code	Title	Years of experience
C1	Industry: Fintech Number of employees: 200+	Participant 1	Engineering Director	23
		Participant 2	Head of product development	17
		Participant 3	Manager	Anonymized
		Participant 4	Engineering manager	14
		Participant 5	Machine learning engineer	4
		Participant 6	Lead machine learning engineer	15
		Participant 7	Software engineer	6
C2	Industry: Pharmaceutical Number of employees: 70+	Participant 8	Engineering director	34
		Participant 9	Business development director	35
		Participant 10	Projects director	30
		Participant 11	Project group manager	8
		Participant 12	Project engineer	2
		Participant 13	Project manager	4
		Participant 14	Project engineer	3

Case Study - C1

C1 is a technology leader in Financial Technology (Fintech) industry and is considered a benchmark company in the UK and globally. The core business

focuses on creating and developing products and solutions for banks and financial services by integrating new technologies in Artificial Intelligence (AI), Machine Learning (ML), Big Data, and cloud solutions, and very knowledge-intensive, focusing on applied research.

Following its launch in 2014 as a startup SME, the firm is considered a fast-growing firm. The revenue has doubled in recent years, and the business expanded to over 400 enterprise clients across 70 countries. From the outset, its strategy focused on growth, market expansion, and building innovative products and solutions by pushing financial crime-fighting technology boundaries.

The company's success depends a lot on engineers' initiatives to drive innovation as they play a major role in creating new ideas, exploring new opportunities, and deploying innovation to achieve a competitive advantage in the market. Innovation is not exclusive to certain engineers but is expected from all engineers regardless of their level, experience, or function. They empower engineers to act as innovators so that they can effectively contribute towards addressing market gaps and customer challenges by exploring and applying new solutions.

The intrapreneurial setup in C1 reflects a mix of different elements of management support, including that along the innovation process, building a supportive culture, and creating a clear vision and strategy that determine how the firm succeeds in harnessing its engineers' skills and capabilities.

Leadership and Management Support

The results indicate that management support is crucial for success in the intrapreneurship process, starting from idea generation to idea development and finally implementation. Managers play a major role in encouraging and supporting ideas initiated by their engineers. In C1, they appear to be very receptive and welcoming to new ideas. According to Participant 5, "my direct manager or his manager always encourages new ideas and suggestions. They are coming from an engineering background and have a sense of engineering ideas". C1 runs quarterly meetings for all engineers with a focus on idea sharing. This gives them a platform to present new ideas directly to their managers and executive team and get feedback, suggestions, and advice on how to take things forward. Engineers are encouraged to discuss any new ideas or suggestions regardless of its perceived quality.

One of the important roles for managers is to discuss ideas brought in by their engineers and challenge them if needed. Participant 1 explains that a good manager always explores and reviews the idea with their engineers and asks challenging questions to shape the idea better so that the engineer has useful feedback to further strengthen the concept. As noted by participant 6, challenging engineers will make the idea better so as to convince higher management in the later stages. Further steps are taken so as to conduct a feasibility study and evaluate the value of the idea and how it fits within the firm's strategy. Managers in C1 has been able to provide this level of technical support as they all have engineering/technical background. Such background allows managers to understand the technical

aspects of their teams' initiatives. They can easily mentor engineers in these areas due to their familiarity with the subject. Participant 1, who is a manager, says, "I think because I have come from an engineering background, I can understand the engineers when they explain their ideas. Managers need to have the same mind as engineers and to be close to speaking the same language so engineers can easily communicate with them".

Intrapreneurial Culture in C1

In C1, an intrapreneurial culture is related to management practices driven mainly by the Kaizen[1] process, which results in creating a supportive culture based on continuous improvement where engineers and managers from all levels are actively engaged in suggesting and implementing improvement to the company. Applying Kaizen is an advantage to C1 in terms of driving their culture and structuring different engineering teams so as to build a learning environment based on effective teamwork and collaborative working style. Teams are structured with reference to Kaizen in an agile and self-organizing way consisting of tribes and squads. Different tribes of engineers are working on different product lines consisting of multi squads.

This structure of tribes and squads formed from different engineering expertise and disciplines makes every team very independent, owning specific parts of functionality end to end, integrating different perspectives and experiences, and enabling knowledge sharing among team members. The firm is working on advanced and complex technologies, and part of the Kaizen value is to provide an opportunity for engineers to learn and build new competencies continually. This structure allows the management to quickly build teams and provide the opportunity for engineers to move between different squads. In particular, one aspect of achieving a Kaizen culture is to motivate engineers for technical learning and upskill their capabilities. According to participant 4, "I think the most important thing is to make sure that your team is motivated for learning, there are multiple ways to encourage people to learn and support them, provide them options like watching related videos, attend seminars and conferences, study groups and latest article discussion and knowledge sharing".

The culture in this company is a construct of multiple mechanisms that are supported by managers. These intrapreneurial factors and mechanisms are aimed at spreading freedom and flexibility in every aspect, recognizing and appreciating

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[1]"Kaizen" refers to a Japanese word which means "improvement" or "change for the better". Kaizen is defined as a continuous effort by each and every employee (from the CEO to field staff) to ensure improvement of all processes and systems of a particular organization. Today KAIZEN™ is recognized worldwide as an important pillar of an organization's long-term competitive strategy. Since introducing this term as a systematic approach for business improvement, companies that implement KAIZEN™ have continually yielded superior results. The implementation of the principles of KAIZEN in any organization is fundamentally important for a successful Continuous Improvement culture and to mark a turning point in the progression of quality, productivity, and labor-management relations.

engineers for their contribution to innovation, ensuring a good communication level between team members and with their subordinate and higher management, and providing support system with adequate resources in place.

The following section will discuss how managers in C1 have succeeded in establishing an intrapreneurial culture for their engineers:

Flexibility in an Engineering Role

Managers in C1 are keen on supporting a flexible culture, particularly with their engineers' roles. Engineers are given the freedom to innovate, and in this context, participant 1 notes, "The way to motivate engineers is to give the space to innovate, provide them the problem and give them the freedom on how to solve it within the right constraints". Participant 4 similarly explains how the freedom given to implement innovation will provide engineers with more innovative options to explore new ways and new technologies, "We give engineers the objectives and the goals that we want to achieve, and it is up to them to come up with some ideas and solution which can be implemented to achieve these goals... By encouraging autonomy, it will encourage engineers to work independently and have their own decision as long as it is aligned with the vision". In this context, freedom allows engineers to solve problems and start working to create innovative solutions without having to consult their managers for permission. As noted by Azami (2013), intrapreneurship motivates employees to come up with distinctive business initiatives without necessarily taking formal permission from the management. In this regard, participant 1, as a manager, clarifies, "I am empowering engineers within the teams to have the autonomy, I am very clear that if somebody spotted a problem, my first response is, can you fix it? People do not need to ask my permission to do or try something sensible. Even if it is something that ultimately fails, they do not need to seek my permission to try or do. They need my permission if they want to go far off the roadmap or to miss customer commitments". This encourages engineers to enjoy finding their own way of doing things, managing their work, and taking ownership without consulting their leaders.

Recognition, Appreciation, and Rewards

Another significant aspect of managers' support is the recognition, appreciation, and rewarding of innovative efforts. C1 has adequate attractive and competitive reward systems with various benefits and incentives that influence their intrapreneurial culture. The firm is providing a transparent system of rewards based on engineers' achievements and contributions to innovation. According to participant 3, "We ensure that all compensation and benefits are in line, and we are not offering to pay unfairly. So if somebody who constantly keeps bringing new projects and innovation into the business, even though you are a senior software engineer, you may be paid very differently to another senior software engineer who has not submitted any projects or not going above and beyond".

In this firm, it is clear that the level of rewards and salaries is not only granted for good technical skills but also related to the innovation created and the extra performance shown within the business. Here engineers feel that they are valued

and appreciated for their efforts. Some engineers are satisfied with the recognition from their manager, whereas some prefer simple rewards such as an Amazon voucher. Participant 5 highlights that "We have a quarterly top management team meetings where if anyone has done something particularly exceptional, then it is announced to the organization".

Resources Availability

Managers are very supportive of providing various resources to their engineers so as to facilitate the process of innovation. This encompasses financial support for experiments and testing and the allocation of professional expertise to provide further guidance if needed. For example, participant 2 explains, "Our management supports to secure the required expertise from engineering teams and bring non-engineering resources to the equation of innovation to exploit it, they pull all sort of resources to make it a success". Engineers have access to most of the firm resources when embarking on innovation. They have the freedom to use the existing tools, software, and lab facilities to support them to work on their own ideas and pursue innovation.

Communication and Frequent Team Meetings

In this open culture, flexible communication methods are well established throughout the entire organization so that engineers can express and share their ideas. Managers play a significant role in the communication between the engineers and the executive team. They bridge the two layers and facilitate communication on both sides. They encourage and get updates and feedback from engineers then feed up to upper management. Furthermore, engineers can contact the executive team and the CEO directly and discuss with them any new ideas. Participant 5 mentioned that he could reach out to other managers besides his own manager to discuss any initiative or idea. He commented that other managers are easily reachable and approachable.

Managers are keen to communicate with their engineers on a friendly basis and keep them updated about any news related to the firm, clients, and the industry, so engineers remain tuned and aligned.

Alignment with Company's Vision

The firm has started with a clear vision that aims to solve financial crimes across the world. This vision motivates everyone in the firm to deliver innovative products that make a significant contribution to society and peoples' lives.

The clarity of the strategy is critical to promote innovation as a way to deploy the strategy. The organization sets the overall strategies for the future with clear goals to achieve, and here the management believes in sharing the vision across all employees. The yearly goals are classified into specific themes quarterly and shared in advance with all engineers so that they can think about it. On the team level, managers define general themes and leave it for engineers to decide how to achieve these goals and how to solve the relevant market challenges. According to participant 7, "Our entire work is based on the company's objectives. So that it is

being shared and discussed across the company, not only on the higher level but also on every level of hierarchy". Here the role of engineering managers is crucial, as participant 4 explains, "My role is not to dictate the vision. My role is to communicate the vision and make sure that goals are very well defined, and convince engineers that it is the right one that takes the company in the right direction".

The management in C1 is always transparent about their vision and goals and is open to discuss these with their engineers. For every level of granularity, engineers have the right to ask questions and understand why the team has agreed on specific goals, and obviously, they know what they are doing and how it fits with respect to the company's overall long-term goals. Sharing the vision on every level and involving all engineers will convince engineers to be part of the strategy as they consider themselves partners in charting the organization's direction. Engineers are encouraged to give feedback on the strategy. According to participant 3, "We try to encourage engineers to give very honest feedback in the engagement surveys and also in the one-to-one meeting with their managers…. the vision and our mission keep us all guided and aligned throughout the year, but in terms of their team ways of working, everybody should be very flexible about it".

Such clarity with the company's growth, direction, and vision and the management's support to translate these into clear goals can facilitate the innovation initiated by engineers.

Case Study - C2

C2 is a world-class engineering and process automation company that operates in the pharmaceutical and medical industries. The firm's core business focuses on designing, manufacturing, and supporting high-end production equipment and machinery through the development of custom technology. The company offers a powerful combination of product development and customized automation skills and methodologies to help customers develop, launch and commercialize new products faster and at a lower cost.

Since it was founded in 2006, the firm has grown rapidly with around 10% year-on-year profit increase. The firm has more than 500 global clients, and its specialists have been named on more than 250 patents across a broad range of products and solutions. The firm has expanded its business among multiple markets, including pharmaceuticals, medical devices, confectionery, household goods, and personal care. Recently they have entered a new market which is the food industry.

The firm is an engineering-intensive resource with around 80 employees. More than 80% of their employees are engineers who come from diverse backgrounds such as electronic, software, and mechanical engineering. Fundamental to this firm's growth and success is the investment in the skills of engineers and having a powerful combination of their intellectual talent, high-quality engineering, and knowledge across-industry.

Creating Well-Rounded Engineers

The firm's recruitment strategy focuses on the hunt for creative and energetic graduate engineers, who like learning about multiple technologies, can think laterally, and enjoy a technically challenging environment. The recruitment process focuses on recruiting new graduate engineers who have high academic achievement from well-ranked universities. Participant 11 explains, "We get a lot of grads from high-ranked universities. And I guess at that point, they have already proven they have got the intellectual horsepower… when they arrive, they are fumbling around a little box that is so completely new for them... But we sort of get them up the learning curve quite quickly... And then within about six months or a year, they are almost on their own feet, and they really start to add value".

One of the main strategies used by managers in C2 is to develop well-rounded engineers with a rich diversity of experiences and competencies. Managers focus on developing the experience of new graduate engineers quickly. The Graduate Development Program (GDP) has been developed internally by higher management and expert engineers to equip new engineers with a wide range of technical skills from around the firm. The program focuses on specific core competencies, which are valuable for all engineers. They learn by joining other teams and working on different equipment, tools, software, and technologies. The program lasts for two to three years, and the engineers who undertake this program are encouraged to develop the relevant competencies within the set timeframe. Participant 12, as an engineer, commented on his own experience about the GDP "They want you to see as many parts of the company as possible. So you have got certain targets to meet with different disciplines. So you get skills in pneumatics, electrical drawings, manufacture, product completion, product development, get these different categories in your first two or three years... So they try and keep it broad. You get to see as much of the company as possible… they definitely allow you to do a mixture of skill".

C2 understands that having well-rounded engineers is not just about focusing on their technical skills. They are also very keen on building commercial and business skills among their engineers. In the first four months, engineers are exposed to the business department to learn about their customers, project management, and the commercial side of the business. Participant 12 commented on his own experience "I did a rotation in the business development team for four months. And I learned a lot… there are design reviews, seeing the commercial side of the project, and making those business decisions. And there is a lot more that goes into it than just engineering know-how… it is risk management, and how we evaluate customers, that was really eye-opening… there is a lot of soft skills which are really important like communication with the customer and writing reports".

Management Support Towards the Innovation Process

In C2, managers play a major role in supporting engineers with their innovation initiatives. They act as a technical mentor and sponsor for their

engineers. According to participant 12, "I thoroughly like our managers because they do listen. They are very understanding... they will push innovation, but then they will help you when you need it. They give you a lot of control over the projects and responsibility as well". The findings revealed that managers are always receptive to new ideas, and as most of them are engineers by profession, they challenge their engineers when they come with new ideas/concepts and provide technical support to further shape these.

Managers are encouraging engineers to be active contributors to innovation by working on new ideas and concepts. They welcome any kind of idea, and they believe that there are no weak or bad ideas. This encourages engineers to speak out their thoughts and suggestions. According to participant 11, " It is definitely up to the manager to allow people who are very unsure about their ideas and who sometimes say things like- this is a stupid idea… So managers want definitely to get that enthusiasm up as well". Participant 9 agrees with this perspective and says, "We are making sure to create a safe environment for people to voice ideas… and people do not feel threatened with suggesting new ideas".

Engineers have open channels to voice their idea to any manager at any level in the firm, as explained by participant 12. He adds, "So managers welcome any innovation. So if you have an idea of any sort, you can tell your managers, the directors etc, and they will listen. And then, probably tell other managers and directors and then weigh up whether it is beneficial or not to the company. All ideas are welcomed no matter what they are… everyone's there with open ears and welcome ideas for the company".

Through the nature of the business by running customer projects, managers also encourage ideas that pop out during the project cycle. For example, participant 13 explained how he got a new idea after a conversation with a customer. The next day, he had a discussion with his manager to build this idea further. This idea gave C2 a good opportunity to add value to the project and satisfy their customers.

Similar to C1, managers here are also involved in technical discussions with their engineers. As noted earlier, here, all managers have an engineering background, including the founder and the executive team. In this context, participant 10, as a manager, explains how he is involved with the technical details, "I still get involved with technical projects. I will help project where I can. Typically I will point out where there might be some risks, and it is just through experience… the detail is really important. It is important to have that level of in-depth knowledge and give high-level guidance and make sure engineers are not going in the wrong direction". As a policy of the firm, engineers can potentially be promoted to managerial positions as part of their Continuing Professional Development (CPD). Participant 8 highlights, "We are probably quite weak from a managerial perspective because we do not go looking for good managers, we go looking for good engineers. And then the better ones of those tend to get promoted into managerial positions ". This enables managers to provide technical support to any idea they receive. Participant 13 explains, "If you come with an idea and the managers like it, they will definitely give suggestions… so they never want to shoot you down. They will always want to bring you up, but they are really good at suggesting ways to improve the idea".

Intrapreneurial Culture in C2

The organizational culture within C2 is influenced by a management style that provides freedom for engineers, building competencies, rewarding them, tolerating mistakes, and maintaining effective and open communication. The culture reflects motivating engineers and trusting their capabilities to be an active contributor to the firm's innovation success. Participant 10 describes the culture - "It is a culture with intrapreneurial spirit to discover opportunities and seek a potential solution and create a business out of it". In this context, participant 9 adds, "Trusting engineers is a big part of the culture, showing the trust but also setting a high expectation... you know, we expect engineers to come forward with ideas and contribute and challenge".

Flexibility with an Engineering Role

Part of sustaining an exciting work environment in a technical company is by providing freedom to engineers with their roles. According to participant 9, "In our business, engineers have some level of autonomy, they are in charge of their own work, which keeps people interested in what they do… it's not about money. It is about self-determination". All participants confirmed that there is no micromanagement, and engineers have the flexibility to decide how they go about completing and performing their assigned roles.

In this firm, engineers are also permitted to move between teams to build new skills and strengthen their expertise in new areas. According to participant 8, "We allow engineers to move between roles, teams, and get varied experience… what we encourage within the business is that everybody does a bit of everything. It does keep us quite sharp. It is the downside you never quite become a master of anything… So you have to jump from technology to technology, from industry to industry. And everybody in the business needs to be sharp". This wide variety of experience motivates engineers as it makes their role more dynamic and helps them see the big picture of the entire business, as highlighted by participant 7.

Managers in C2 are keen on making the roles more exciting for their engineers, and hence their roles are designed according to individual interests. In this regard, participant 8 confirms, "We have been able to construct roles around individuals as opposed to having a role and then forcing somebody to do that job". For example, participant 12 explained how she was interviewed for a specific mechanical engineering role, but during the interview stages, they discovered that she had a design background as well. This led her to be assigned to projects related to both areas.

Recognition, Appreciation, and Rewards

The company's reward system has wide monetary and recognition options that are very important to acknowledge and appreciate the innovation initiatives coming from engineers. Participant 9 explains how innovative engineers are rewarded, "if there is a really talented engineer, who is making a mark for themselves and making a difference… we have discretionary bonuses at the end of

each year for these innovative efforts". Also, monetary rewards include salary reviews and increases.

Other forms of recognition include acknowledgment and appreciation from managers to value their engineers' innovative efforts, "I think a big part of recognition is the personal recognition… we acknowledge the engineer and tell him that he did a good job, by their manager, or the Managing Director". Participant 10 highlights that exemplary achievements are announced throughout the firm so that if an engineer in a project achieved something, there would be an email that goes out to everybody. Such recognition will naturally motivate others to express their innovative ideas and go the extra mile.

C2 also has a scheme similar to C1 where some engineers are promoted to managerial positions as part of recognizing their strong capabilities. For instance, participant 13 was promoted to a project manager role only after three years of experience as an engineer. Such a role is usually offered to employees following many years of experience in other companies.

A Culture that Tolerates Failure

One of the motivational factors for engineers in C2 is to pursue innovation without the fear of failures and mistakes. Participant 9 explained, "It is not a blame culture really... I think failure very much happens … Yet you learn from it and move on… we do not tend to have many shouting matches. People are not punished… I do not think in our organization we have ever got rid of anybody because of a mistake he did". Participant 11 explains how fear of failure affects and limit innovation, "people who work for me understand that mistakes can be made sometimes, which hopefully gets through that fear of innovating... Engineers are not afraid to make mistakes or make decisions by themselves, and therefore they are not afraid to innovate at a certain level".

Open Communication and Engineers' Involvement

The open culture and work atmosphere in C2 has been described by all participants in the interviews. Participant 12 explains, "So the culture in the office is very open. To be honest, the people make you try and perform better". Participant 13 summarized the social environment, "It is like a family, you still know everyone's name, You know their partner's name. You know much stuff about them". According to participant 13, there are frequent formal meetings with line managers for general discussion, "once a week you have a meeting with your line manager as a team, and that is where you are given all the updates… you get all the information, and then obviously we get emails throughout the week". However, in C2, the key element is open communication.

Managers are reachable and interact directly with their engineers. What facilitate this interaction is the design of the physical working environment as highlighted by participant 10, "we have an open-plan office. So I think with the open-plan office is an open culture, you know, people communicate directly". This enables engineers to get instant support and help by directly contacting the managers or senior engineers as they sit within a few meters on the same floor. As a result, engineers build a sense of trust with their managers and are encouraged to

voice their ideas directly to management. Therefore, there is a high-quality relationship between employees and managers represented by having mutual confidence/trust, as most participants explained.

Engineers are involved with the overall company getting business updates through open communication with senior executives and line managers. This makes them feel like an integral part of the firm, and their scope is not limited to the news of their team or group. There is effective communication between group heads and their teams of engineers on a monthly basis.

There is a quarterly business update meeting involving all employees. According to participant 11, "Every quarter, so we have a business update meeting against the finances and things like that. But we also got each group head to talk about all the projects that are going in the group at that time. So you get some visibility of the ongoing projects". From the engineers' perspective, they consider this involvement crucial to get a wider sense of what is going on in the business and with other groups.

Alignment with the Company's Vision

Similar to C1, a clear vision of the firm is transferred down to engineers in terms of specific group targets and the expectations from engineers. The group head updates their engineers quarterly on the group target. As an innovative firm based on customer projects, engineers find it challenging to execute the firm vision. Participant 12 explains, "Projects do change, sometimes the nature of the project change, priorities are changed, and sometimes it puts one in a reactive position". He adds how this requires dynamic engineers who are willing to accept and adapt to project changes, "Engineers cannot be uncomfortable with changing what they do. You have to be ready to change and go with the flow…. engineers need to be flexible and accept changes". In C2, engineers show a high commitment to the project plan, deadline and work to the best of their abilities in order to satisfy customers.

Middle managers and group heads are playing a pivotal role in translating the business strategy down to their engineers. Participant 10 explains, "If we are trying to explain to people why we wanted to go down a particular strategic route, we would generally have done the market research. We would put a series of PowerPoint slides together, and we would present them. So maybe first it is presented at board level, but then it would be presented across all engineers".

Engineers are exposed to market research. They are given the opportunity to attend external conferences and the latest trade shows. According to participant 8, such opportunities help engineers in spotting new opportunities and understand competitors and go beyond their technical roles. He notes, "In terms of developing products, one of the things that we tend to do is expose bright engineers to the marketplace at a very early stage in their career. So a lot of engineers are very introverted and very shy and hate going out to competitors... So our best playground for sales and marketing are technical conferences... We will normally send a senior engineer and junior engineers to understand a little bit more about our market and to spot opportunities". One of the successful products developed in

this firm was proposed by a young engineer who spotted the opportunity during a trade show.

Managers authorize engineers to work and interact directly with customers to understand their specific needs, open new conversations, and propose solutions for their challenges. All engineers, regardless of their level, are encouraged to communicate with their customers. Participant 10 adds, "Everybody has the opportunity to generate business and to grow the company. People recognize that they need to see what the competitors are doing and what the industry needs… the industry does not advertise what they need or what they focus on… So engineers have contact with customers, but they need a level of knowledge and the confidence to be able to explore customer's problems. We try to give everybody that exposure". Participant 9 explains how despite having a project leader for each project, all team members are allowed to contact customers and attend customer meetings. Managers facilitate this interaction, and in this context, participant 10 notes, "Everybody should be able to deal with a customer.. most people are good at working with customers…the customer-facing role is important because that is where they really learn… by the nature of engineer some are not good to meet customer and do not perform well in front of customers. So if they continue to do that, we try to guide them and help them to improve... But then if they are not, then they tend to get more technical, internal work and less customer facing". Participant 13 cited an example when interacting with their customers sparked a new innovation. He explained how installing a machine at a customer's site and having a direct chat with them led him to an idea to add a new feature to one of their products. Today it is a successful selling feature for C2.

Discussion

Although the two cases belonged to non-homogeneous industries, similar patterns emerged from the above discussions. Managers can positively impact the overall organizational culture and can empower engineers to engage with intrapreneurship. From the results, the following model (Figure 1) represents the main factors by which managers harness the intrapreneurial capabilities of their engineers.

In both cases, managers seem to come from mostly engineering or technical background, which enable them to understand the technical language of engineers. This helps them to act as technical referees and provide mentoring and support to their engineers along the innovation process. Many engineers consider their managers as role models who inspire them to be proactive and engage with intrapreneurship. Managers provide an environment where engineers feel confident and trusted with any idea, suggestion, or problem they bring to their managers and get justifiable feedback for rejected ideas.

Figure 1. *Management Support for Intrapreneurship in Technology-based SME Model*
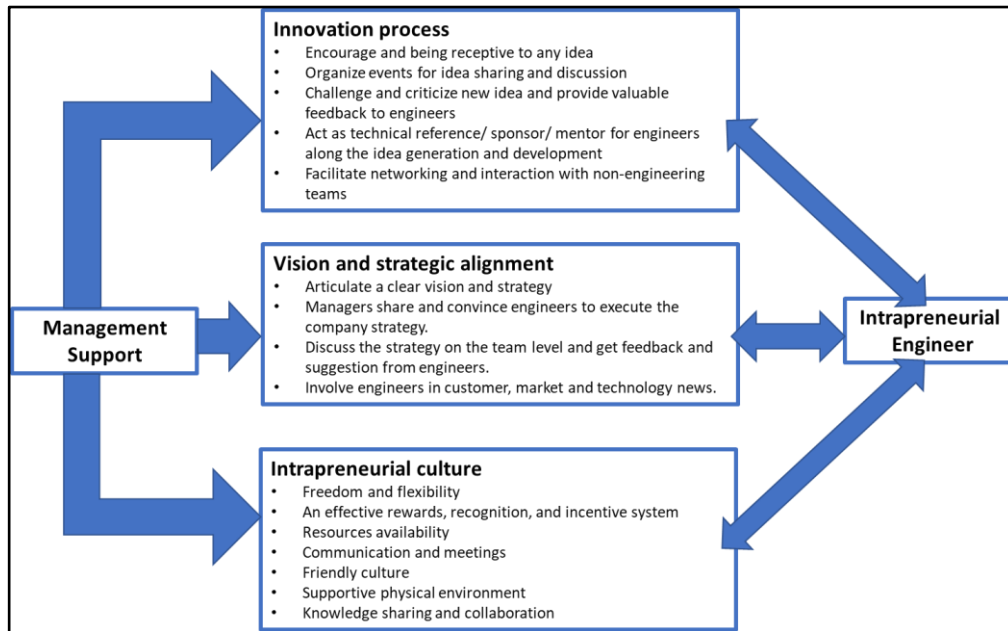
Both C1 and C2 provide flexibility to their engineers to join other teams and get new experience and skills. This gives them opportunities and challenges to work on, exchanging knowledge with other groups and keeping the learning curve going up.

A reward system is important for promoting intrapreneurship as it can have a powerful influence on employees' engagement (Carraher et al. 2003). It is evident that both firms have different mechanisms of monetary and non-monetary incentives to reward engineers. Money may not be the most important motivator of intrapreneurship, as noted by de Villiers-Scheepers (2011). The findings from this study support this view. In this context, participant 10 from C2 confirms, "We find that money remuneration is not the most significant driver for engineers... That is usually sort of short-term rewards, but being associated with something or having your name associated with a solution, I think that is the kind of recognition that lasts". The reward system should be tailored to accommodate the preferences of different engineers. Participant 8 explains, "I think it depends on the engineer. Some engineers love to have papers to their names... Other engineers love bonuses and pay rises. Some engineers love the recognition, so they prefer to be called out in a company event about something great they have done. Some engineers would really hate to have a name mentioned in the company events. So I think it is about the individual".

It is clear that managers create a clear vision and strategy that are reflected and shared at the engineering level with clearly defined objectives and targets. It is very important to keep engineers' initiatives and ideas aligned with the company's vision and strategy. This can be achieved by facilitating continuous interaction between managers and engineers around their business news, market demands and customer requirements, and internal company information.

Conclusion

Intrapreneurship is a mechanism to sustain innovation in any organization. Managers play a significant role in the successful adoption, development, and implementation of intrapreneurship within the firm. However, there has been limited research on the role of managers in supporting and promoting intrapreneurial capabilities of engineers, particularly in technology-based SMEs. This paper attempts to fill this research gap through an exploratory study involving two intrapreneurial organizations from different technological industries.

C1, a leading organization in the Fintech industry, utilizes a Kaizen culture to encourage all engineers to be part of the firm's innovation culture. They push their engineers to be proactive with providing continuous ideas and suggestions so as to create new business opportunities, develop new products, and ensure the improvement of internal processes and ways of working. C2, a world-class engineering and process automation company, views engineers as their main resource power for driving innovation and success. They aim to develop well-rounded experience and multi-disciplinary knowledge among their engineers by harvesting a culture based on friendly and open communication and teamwork spirit.

The results from both case studies revealed that managers play a significant role through their actions, practices, and decision making on empowering engineers to actively engage with intrapreneurship with their roles. They influence an intrapreneurial culture through open communication with their engineers, being receptive to their ideas, and guiding and supporting them along the innovation process. Both firms have established a rewarding culture that recognizes the innovative efforts of engineers through comprehensive options of monetary and non-monetary mechanisms. Freedom and flexibility in engineering roles enable engineers to have independence and make their own decisions. Also, managers allow their engineers to join other teams to gain diverse experience and further strengthen their knowledge. This was clear in the case of C1 through the dynamic of team structuring using tribes and squads. Whereas in C2, engineers were encouraged to develop their skills by joining specific skills development programs.

In both C1 and C2, managers articulate and demonstrate a clear vision with their strategic plans. This helps to align their engineers' innovative initiatives and ambitions with the overall business direction. They encourage their engineers to come up with technology solutions addressing key market challenges that support their mission and business strategies.

This study contributes to the literature by providing some understanding of how management support helps in driving intrapreneurship through their engineers in technology-based SMEs. Managers play an important role in influencing a culture conducive for intrapreneurship, supporting their engineers along the innovation processes, and aligning them to execute the business strategy and vision through their contributions. Managers with technical experience and engineering backgrounds, as seen in these two firms, can be an added advantage for organizations. Such background can help them to be close to their engineers by speaking the same technical language. Having familiarity with the engineering

areas can aid their decision making and act as a role model for coaching and mentoring their engineers. The result of this research will act as a guideline for technology-based firms and academics in understanding the importance of managers in driving intrapreneurship and utilizing the competencies of their engineers.

Building on the research discussion, managers are considered as an enabler for engineers' intrapreneurial behavior. According to Gerards et al. (2021), this represents a transformational leadership style in which leaders provide clear direction and a vision for achieving common goals while inspiring and motivating employees to strive for success. Moriano et al. (2014) established a positive correlation between transformational leadership and intrapreneurial behavior of employees. In this context, future research could focus on exploring the management styles of managers and how specific characteristics and skills could support their roles in developing the intrapreneurial culture within an organization.

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