International Journal of Advanced Engineering Research and Science (IJAERS)
Peer-Reviewed Journal
ISSN: 2349-6495(P) | 2456-1908(O)
Vol-9, Issue-8; Aug, 2022
Journal Home Page Available: https://ijaers.com/
Article DOI: https://dx.doi.org/10.22161/ijaers.98.18

Leadership process in an innovation team at Nokia: An analysis from the Complex Leadership Theory (CLT)

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Received: 09 Jul 2022,

Received in revised form: 02 Aug 2022,

Accepted: 08 Aug 2022,

Available online: 12 Aug 2022

***Keywords*— Innovation, Innovation Team; Nokia, Complex Leadership Theory.**

***Abstract*—** *This research aims to understand how leadership processes occur in an innovation team of Nokia Networks - Brazil, through the Complex Leadership Theory. By using interpretive research methodology and in-depth interviews, we found in the administrative function: 1) leadership emerges according to the context and develops in a distributed way; 2) the strategic alignment of the team and the contribution of resources are facilitators for innovation. Regarding the adaptive function: 1) collaborative work among project members provides a shared learning environment that generates innovation and team flexibility for changes; 2) there are constant team interactions with other Complex Adaptive Systems for idea generation and new solutions. And in the enabling function: 1) team members are empowered in project development; 2) the feedback contributes to the creation of a transparent and trusting environment; 3) encouraging learning motivates teams to invest time and effort in finding new solutions and achieving project goals.*

I. INTRODUCTION

Rapid technological changes, shortened product lifecycles, and globalization put pressure on organizations to be more creative and innovative - which are conditions to survive, compete, grow and lead [13].

Faced with increasingly complex and emerging environments [10], where unpredictability, dynamism, and uncertainty prevail, the traditional view of leadership centered on the leader-follower relationship is re-evaluated. It is no longer about the leader influencing followers to meet the aspirations of the leaders, but about members interacting to generate innovative results [17][18].

In this case, a new concept of leadership is necessary, allowing multiple models of network influence, creative ideas flow, and the emergence of innovation [18]. Due to the dynamic, unpredictable, and innovative context, leadership studies are adopting a new paradigm. While the traditional paradigm is based on command and control, the new one, proposed by the Complex Leadership Theory (CLT) [23], prioritizes interconnectivity, based on the Complexity Theory and refutes bureaucratic notions of control and predictability. According to the CLT, leadership is considered a complex, adaptive, nonlinear phenomenon that occurs as an interactive process in a network [42].

CLT is particularly suited to situations where groups or teams need to learn how to solve problems and unpredictable situations, in collaborative [43] and shared [31] ways, especially in emerging and complex environments [10][16][23][32][38]. Groups are considered Complex Adaptive Systems (CAS), networks of

interacting people functioning as interdependent agents, linked by a cooperative dynamic of common goals [22].

The interaction among the members of one SAC and with other CASs generates collaborative learning that, in turn, has a positive influence on innovation [6][9][31]. From this perspective, every innovation team is characterized as a CAS. Innovation, in this context, results not from the leader's view, but from the interaction among agents, who interact to deal with issues that need to be resolved [22]. Marion (1999; 2006) states that many agents working together is better able to create and learn than isolated individuals.

By the CLT, organizations are seen as living systems, which are in continuous motion that describe three leadership functions: adaptive, administrative, and enabling [40], whose intertwining generates the learning necessary for innovation [26]. The theory does not ignore traditional leadership behaviors, but provides a new view on leadership in complex contexts [10][19][41], just like in innovation teams. In these teams, the environment is often characterized as interactive and unpredictable [25], and leadership emerges according to the development in a procedural and shared manner [12][32], generating an environment focused on learning and innovation [6][9][26][31][39].

In scientific literature, there are few empirical studies aimed at understanding the process of leadership in innovation teams according to CLT. In this manner, the present paper intends to answer the following research question: how does leadership take place in an innovation team at Nokia from the perspective of CLT?

II. LITERATURE REVIEW

Complex Leadership Theory

Complex Leadership Theory (CLT) originated from complexity theory [21], which considers organizations as Complex Adaptive Systems, that is, composed of a diversity of interacting agents, mutually affecting each other, and thereby generating new behaviors for the system as a whole [22].

SACs are mutable structures that overlap in multiple hierarchies. These systems are linked together in a dynamic and interactive network of people. The resulting structure resembles knowledge flows in organizations, and is therefore called by Hedlund (1994) "temporary constellations of people and units". CAS can solve problems, learn and adapt quickly and creatively.

For CLT, organizations and their leaders are products of these dynamic interactions; therefore, leaders do not create the system, but affect it and are affected by it by an aggregation and emergence process. It also does not address leadership as necessarily embedded in the formal hierarchy, but as a phenomenon that permeates the organization. With this, the differences between leader and subordinate become smaller, because leadership depends on the context, that is, in a given context, one individual may be the leader, and in another context, the subordinate [21].

According to the theory, the leader can affect the organizational system through what McKelvey (2001) calls distributed intelligence. In this perspective, the results of the organization are achieved due to the connectivity between the several agents that can affect the top of the structure and, thus, establish new ideas that generate innovations.

The model proposed by CLT focuses more on creating conditions that facilitate the emergence of distributed leadership than on the discussion of individual behavior. Distributed leadership is characterized by the dissolution of authority, which makes it possible to solve problems and create innovation in an organization or system, usually by using bottom-up relationships, not solely based on hierarchy [22][23][24].

Figure 1 presents the three complex leadership functions (adaptive, administrative, and enabling), which, according to CLT, explain how leadership emerges and occurs [12][40].

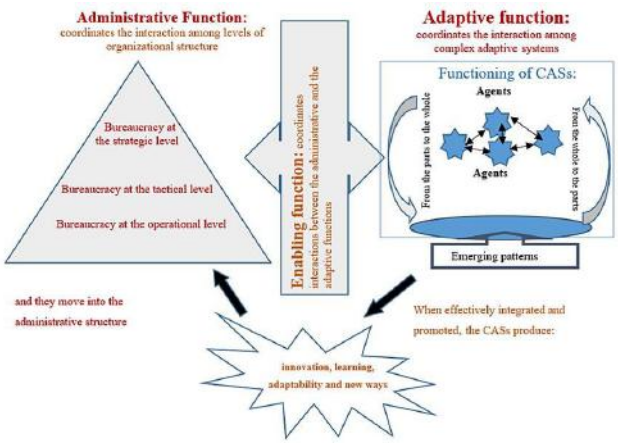

Fig. 1: Three Functions of the Complex Leadership Theory. Source: adapted from [40]

The function is described as follows.

Administrative function

The administrative function refers to the actions of individuals in management and formal positions, and their nature varies according to the hierarchical level in the system. At the strategic level, leaders engage in strategic planning, coordination, resource acquisition, and

structuring conditions related to the strategy of the organization. Leaders at the intermediate level are more focused on coordinating creative operations, managing resource allocation, and framework conditions, within which the adaptive function (detailed in 2.1.2) takes place. At the operational level, planned activities are implemented and operationalized. Traditionally, administrative leadership is a top-down function based on the authority and position of power. However, considering the dynamics of complexity, some authors suggest that management leadership should exercise authority by reflecting on the need for creativity, learning, and adaptability in organizations [39][40][41]. According to Uhl-Bien and Marion (2009), the administrative function can impact the organization's adaptive capacity as the formal structure and the resources it manages to impact the interactions between an organization's CASs and, consequently, the organizational performance.

Adaptive function

For Uhl-Bien and Marion (2009, p. 643), the adaptive function is an informal process that "originates in disputes between agents or collectives as they engage in meaning-making or problem-solving under ambiguous or complex adaptive conditions [. .] and dynamic pressures". The adaptive function involves the organization as a whole and results in "cooperative efforts and alliances of people, ideas and technologies" (Uhl-Bien and Marion, 2009, p. 643).

While people are key, the focus of the adaptive function is on interactions between agents since these interactions drive change and innovation in the organization. Adaptive change is produced by the clash of seemingly incompatible ideas, existing knowledge, and technologies. It results in learning, adaptation, or new knowledge and creative ideas. The most common form of this type of change occurs when two interdependent agents debate conflicting perceptions about a subject. At any given time, and perhaps at the same time, they generate a new understanding of the issue discussed - this can be considered the "aha" moment. This moment is the product of a nonlinear combination of meta-perceptions, the discarding of unsustainable arguments, and the fusion of what is sustainable. It can also be the product of rejecting original ideas (meta-ideas), because they are unsustainable, or the creation of another idea entirely new. This type of change represents a process that goes beyond the original assumptions (meta-premises) and generates something different [40].

Adaptation is related to the experience, knowledge, flexibility, and creativity of the agents who act and generate change by creative thinking. Complex systems [10] depend on these factors and impulses from the internal and external environments to generate innovations.

Enabling function

The enabling acts as an interface and a facilitator of the intertwining of the administrative and adaptive functions employing two mechanisms: first, it creates conditions for the emergence of adaptive leadership; and second, it enables management leadership to assimilate emerging outcomes produced by adaptive leadership (Uhl- Bien and Marion, 2009, p. 636). Thus, this function creates a favorable environment for emergence and innovation to thrive in the organization [9].

The enabling function partially overlaps the administrative function, as it can be performed by agents acting at the managerial level since they have access to resources and have direct involvement in production systems. Besides, a single agent can aggregate both the enabling and the adaptive function depending on the situation.

The major function of the enabling function, according to Uhl-Bien, Marion, and McKelvey (2007, p. 310), are:

• create and foster conditions that allow mechanisms and contexts to interact so that the adaptive function operates effectively;

• enable the administrative function to intertwine with the adaptive, so that agent networks can interact more intensely, and those products and innovations are disseminated and supported to improve organizational performance;

• promote interdependence and coordination of efforts among agents and CASs to provide articulated work environments with multidisciplinary teams;

• enable tension to be a motivating and articulating factor for interactive dynamics between agents;

• support and promote contact networks and information flows so that agents can develop their activities in an integrated manner;

• promote interaction between several CASs to foster different ideas and, thus, transform them into more valuable ones that generate learning and innovation for the organization;

• promote a flexible environment that is adaptable to environmental changes so that agents can monitor and act on this environment;

• support the empowerment and autonomy (own ideas) of actors, which enables the emergence of "conflicting constraints and allows agents to work with these constraints without interference from formal authorities".

In this manner, according to the CLT, the intertwining of the three functions generates learning and innovation [40], and the next section discusses how it occurs.

CLT, learning, and innovation

CLT presupposes an interactive, adaptive, networked, non-linear leadership process [12][39], in which each team member can, as appropriate, assume the leadership role. Members interact and provide feedback to help with tasks and reinforce learning [38]. Interaction occurs when multiple agents connect meaningfully within an organizational context [15]. For Arrow, McGrath, and Berdahl (2000), small groups that interact with each other and exchange information (eg, teams, departments) act as CASs. These interactions can occur between CAS members, between different CASs, and within the external environment of the organization. These are vital for shared learning [39][42].

According to Delia (2011), shared learning happens when people share and understand knowledge together by interaction and interdependence, which, in turn, are enabled by complex leadership. CLT generates shared learning which, in turn, has a positive influence on the results of the innovation team. Ott (2010) corroborates this understanding by stating that CLT is the most appropriate lens to understand organizational leadership in highly changing and innovative contexts.

In complex contexts, Ott (2010) adds that leaders need to foster interaction among individuals, teams, and information to provide an adaptive and shared learning environment. These factors are relevant to the generation of innovation since leadership is not the sole property of individuals. For O'Connor and Quinn (2004), when leadership is viewed systemically, its effectiveness becomes more than a product of interactions between the parties. Leadership and creativity become the property of the collective, enabling bottom-up interactions and fostering innovation [30][33][34][35].

According to Marion and Uhl-Bien (2001), agents interact, they tend to adjust to each other's worldviews and create temporarily more stable and more interactive sub-units. In this process of interaction, they learn from each other and take the system into new dynamic states [1]. This phenomenon contributes to the emergence of more appropriate adaptive states that usually manifest as innovation [22].

However, not all interactions are effective, and therefore do not promote learning and innovation. Uhl-Bien et al. (2007) point out that interaction between agents can only be effective if they interact freely with each other and with their larger environment, if they are mutually dependent on each other, and if any stress in the environment requires them to come up with solutions. Boal and Schlutz (2007) corroborate this last statement, concluding that in CAS innovative behaviors can emerge from the interaction of agent groups when they have to solve a problem. Mendes et al. (2016) propose that innovation occurs based on the interaction between CLT's administrative, adaptive and enabling functions. As far as innovation is concerned, these functions do not occur in isolation, and each of them plays an important function within the CLT. Collectively, the three functions extend the ability of organizations to harness the potential for learning and innovation.

Leadership in Innovation Teams

The team-based framework provides the flexibility needed for organizations to respond quickly and effectively to the demands of an ever-changing environment [44]. According to Delia (2011), an innovative team has heterogeneous experts in its composition and is perceived skills as having special learning and innovation.

Also, for Delia (2011), there are two characteristics and dynamics of innovation teams that characterize them as a CAS. The first feature refers to the heterogeneity of the members of an innovation team, made up of people who have varied knowledge and different functional skills and competencies. The second feature is that the interactions of innovation team members can be both internal and external, that is, the members of the innovation team interact with each other and with the external environment. Interaction and interdependence among agents are vital to the functioning of the CAS and produce creativity and learning [41].

After identifying that an innovation team can be analyzed as a CAS, Delia (2011) describes each of CLT's three functions in an innovation team. The managerial function in an innovation team is usually performed by a formally appointed leader, who guides the team and connects their processes to the strategies of the company [5][33][36]. The adaptive function of CLT, in turn, occurs in innovation teams when members need to interact to solve any disagreements or problems. By interacting, they generate behaviors that foster innovation. Finally, the enabling function in teams' innovation, in addition to connecting the administrative and adaptive functions, creates a favorable environment for emergency and innovation to be fostered within the organization [9].

III. RESEARCH METHODOLOGY

To achieve the objective proposed in the present paper, interpretive research [28] was used, having in-depth

interviews as data collection. According to Taylor and Bogdan (1997), this kind of method is characterized by the investigation of a social phenomenon from the perception of the actors themselves, who are immersed in the situation being observed live and investigated [27]. Initially, we sought to understand the characteristics of Nokia's innovation team and its context based on the following aspects:

• general identification of the innovation team (name, age, position, education, professional experience, time in the company/experience in the company);

• understanding of hierarchical levels based on the researchers' perception of relationships in the workplace;

• comprehension of the team routine - how the team routine works in the project development process, including disentangling the technical terms;

• understanding of team interactions with other sectors of the company, as well as external stakeholders such as customers, suppliers, and competitors.

A semi-structured interview script was adopted, with questions based on the CLT functions (administrative, adaptive, and enabling) in an innovation team. Five interviews were conducted with members of the innovation team linked to the Laboratory for Advanced Studies in Mobile Telecommunications Networks - a partnership between the Pontifical Catholic University of Paraná (PUC-PR) and Nokia Networks. Before each interview, the researchers explained the object and the research theme. The respondent was asked to read and, if they agreed, to sign an Informed Consent Form (ICF). The respondents' profile is presented in Table 1:

Table 1. respondents' profile

RESPONDENT'S PROFILE				
Respondent 1 (R1)	Respondent 2 (R2)	Respondent 3 (R3)	Respondent 4 (R4)	Respondent 5 (R5)
- Electrical engineer. - Nokia employee. - Nokia Project Executive Coordinator. - 33 years of experience in R&D project development.	- electrical engineer - PUC-PR employee. - Coordinator of the Electrical Engineering Course at PUCPR. - PUC-PR Project General Coordinator. - 27 years of experience in the areas of information technology, computer networks, and communication systems.	- Computer engineer. - PUCPR employee and technical developer in the project. - 5 months of experience in software development.	- Computer engineer. - PUC-PR Employee and Analyst Technical (Senior) Developer in the Project. - 3 years of experience in software development.	- Computer engineer. - PUC-PR employee. - PUC-PR Coordinator of the Computer Engineering Course. - Ad hoc researcher in embedded systems in the project, with 20 years of experience in the area.

Source: Research Data (2018)

Data analysis was performed using the method proposed by Taylor and Bogdan (1997), which consists of the preparation of information (gathering the necessary material for the analysis); classification of the material into categories (grouping the data by sorting them by similarity or analogy); description (report search results); and interpretation (infer from the data reported in the research).

IV. DATA PRESENTATION AND ANALYSIS

In this section, the data collected in the interviews are presented and analyzed. Data analysis is structured based on the CLT macro-dimensions: administrative, adaptive, and enabling functions, to which thematic categories were associated. The results are described from the intertwining of the CLT functions, highlighting the categories that emerged from the interviews.

Laboratory of Advanced Studies in Mobile Telecommunications Networks

The research was conducted with the Nokia Networks/Brazil innovation team, in partnership with the Pontifical Catholic University of Paraná (PUC-PR), whose project consists of a proof of concept connected to the internet of things using innovative protocols, focused on precision agriculture for monitoring and prediction of the Asian rust, a pest that attacks soy.

The project was developed at the Laboratory of Advanced Studies in Mobile Telecommunications Networks, which is coordinated by the Electrical Engineering Course of PUC-PR/BR. The laboratory is a space for cooperation between the University and Nokia, and its scope is to conduct advanced studies, staff training, and technology development for the 4th and 5th generations.

The solution developed in this project consists of a sensor system, which works seamlessly with a cloud Internet of Things (IoT) platform and the application responsible for analyzing data and notifying end users. It innovates by using emerging cellular technologies focused on IoT applications: LTE-M (Long Term Evolution) and NB-IoT (Narrowband Internet of Things).

The project is expected to last 10 months, and the team was interviewed in April 2018, the last month of implementation. The partnership between PUC-PR and Nokia has been taking place in other projects since 2009, having been intensified since 2014. See as follows the results of the analysis of the leadership process in Nokia's innovation team based on the three functions of CLT: administrative; adaptive and enabling.

CLT Administrative Function

Regarding the administrative function, we sought to identify the actions of people who held managerial positions, formally designated, in the team. From the data analysis, the following constituents of the administrative function were identified: hierarchical structure, financial resources, technological resources, and people.

Regarding the administrative function, we sought to identify the actions of people who were formally assigned managerial positions in the team. From the data analysis, the following elements of the administrative function were identified: hierarchical structure, financial resources, technological resources, and people. In what concerns the hierarchical structure, it was possible to identify that, despite being formally assigned the functions of Project Executive Coordinator by Nokia, R1, and Project General Coordinator by PUC, R2, the structure of the innovation team is organic [7][8]. Leadership emerges in context and develops in a procedural, shared form [32], and is distributed [20][21][22][23].

In many situations, project leadership is not based on hierarchy, but on bottom-up relationships, as affirmed by the PUC General Project Coordinator (R2): “In many situations, they (the technical project developers) exercise the leadership (...). Broadly speaking, they take the lead.” His words were reinforced by the project's own (senior) technical developer's perception: “When the issue is more technical (...), then I think I should take the lead (...)” (R4).

Therefore, the prevailing administrative function model in the researched team is in line with what Uhl-Bien and Marion (2009) advocate, stating that a company that works with development and seeks innovation as a competitive advantage needs to adopt a more organic structure. This statement is also in line with the studies by Quinn (2004), Sweetman (2010), and Cochran (2013), which demonstrate that an organizational structure that allows for distributed leadership, bottom-up relationships, and clear and fluid communication, promotes the emergence of complex adaptive systems that consequently contribute to generating innovations.

The project team has financial, technological, and human support from both PUC-PR and Nokia. These resources, due to the university-company partnership, are managed by the two project coordinators. According to the PUC-PR Project's General Coordinator for (R2), the largest contribution of financial resources is from Nokia, formally represented by the Project's Executive Coordinator. The Executive Coordinator has “full responsibility for keeping and conducting investments throughout the project” (R2), even if there is a joint definition of the project scope between him and the PUC-PR technical coordinator. Also, according to R2, “He (the executive coordinator) is the project manager within Nokia, (...) he is our interlocutor with Nokia. (...)”.

In what concerns technological resources, there is a division of tasks between PUC-PR and Nokia. PUC-PR's team of professors supports the definition of the technological structure of the project, aiming to develop more innovative and complex solutions. Nokia, in turn, invests in new equipment, which is confirmed by R3's statement: “when we need new equipment, something we don't have here, (...) the project's executive coordinator usually passes it on to Nokia and gets the equipment”.

Regarding people, data analysis shows the importance of the university-business partnership [11]. Several professionals were ceded by the university. In addition to the Project General Coordinator, who acts as the technical manager, the team has the ad hoc consultancy of a PUC-PR professor who is knowledgeable in embedded systems

and two developers who are engineers hired by PUC-PR involved in the daily execution of the project. According to one of the respondents: "We invite these teachers to participate in the projects, advising on certain subjects that they have the expertise, and they also participate weekly in the project meetings" (R2).

At Nokia, the project executive coordinator acts as a facilitator. He is the interface between the project team and Nokia's strategic group, besides acting as a link between the project and Nokia and promoting the strategic alignment of the team. In the group, he is considered a facilitator for the development of new knowledge and the generation of innovation.

CLT Adaptive Function

Regarding the adaptive function, we sought to understand how it acts on the learning and innovation processes. To understand this relationship, it was necessary to investigate two points: how the team adjusts to the challenges and unforeseen issues inherent in project execution, and how the process of interaction among team agents and of agents with other CASs takes place.

When asked about unforeseen events that led the team to overcome challenges, thus generating learning and innovation, the case of the LTE-M and NB-IoT protocols was remembered. The providers of these protocols have not delivered the appropriate interface configurations for joint use as initially promised to Nokia. This forced the innovation team to make major design changes, demonstrating flexibility and resilience. At the same time, it also generated great learning since the team had to interact with suppliers in search of a new solution. According to Respondent 1: "We had difficulties with the purchased device (...), we had to contact the suppliers (...), and we re-scheduled our activities. So, this is part of our everyday lives (...) to achieve the objectives of the project."

The learning and innovation processes that occurred in the case of the protocols are supported by Boal and Schlutz (2007) and Delia (2011). According to these authors, in CASs, innovative behaviors can emerge from the interaction between groups of agents whenever they have to solve a problem. Regarding the interaction process within the CAS, it occurred in an emergent, informal, and frequent manner among the members of the innovation team, then generating new solutions. The interaction with other CASs, especially external ones, was facilitated by the university-company partnership [11].

In interacting with external customers, we identify the interactions between Nokia and the telephone operators. To explain this interaction, the ad hoc researcher (Respondent 5) highlighted that: “In general, a demand between Nokia itself and an outside company often has to do with telephone companies (…) and it is required from it (Nokia) a project idea that is innovative (...), from this on, the team is raised (...)”.

Interactions with external customers influenced the project due to the demands they presented to Nokia. In the project studied specifically, the Alfa operator, Nokia partner, showed interest in the project solutions related to incorporating 4G into more innovative products. According to Respondent 1: “For example, one of the partners interested in this project is Alfa operator, because of the 4G communication we will use in the project, so as one of Nokia's customers, it is also interested in the project.”

Especially in the early phase of the project, there were interactions of the project team with other areas of PUC-PR to expand the generation of ideas and solutions. According to the General Project Coordinator (R2), "in the planning phase, where the scope of the project was still in discussion, I required technical support from the Agronomy teachers because they had specific competencies", which were necessary to develop agribusiness solutions.

In addition to the partnership with the Agronomy program, the project team counts on the collaboration of teachers from different areas of engineering. They act as consultants and are incorporated into the innovation team when specific problems arise in the project. As observed in the words of Respondent 3: “(...) when we have a major challenge, first we talk to the General Project Coordinator, (...) depending on the area, then we also talk to another teacher. (...) Then we talk to the ad hoc researcher in the area of embedded systems, who is the most experienced in this area to help us.”

The innovation team interacts with other internal and external CASs to solve problems and seek innovative solutions. These interactions contribute to the stability and self-efficacy of the team, who consider themselves prepared to face emerging situations. As emphasized by Delia (2011), Ott (2010), and Cochran (2013), these interactions generate collaborative learning which, in turn, has a positive influence on innovation. These effects of interactions were observed by Gramkow (2016), who analyzed a software development team.

In the present case, the interaction of the technical team with project suppliers stands out. For instance, to solve difficulties with the LTE-M protocol, an articulation was promoted between the engineers of the innovation team and the protocol suppliers. Together, they were able to solve the problem and incorporate this protocol into the solution, generating the intended innovation that reduced

energy consumption in the use of the soybean Asian rust monitoring devices. According to one of the respondents (R3): “At the time, we contacted the suppliers directly to find a solution with them (...) and they gave us some solutions for our test environment to make it work, and that’s for the LTE-M only.”

Another type of interaction considered important for the project is between university and company, fundamental to generating knowledge and innovation. According to Respondent 5: "The scientific knowledge we have here cannot simply be developed to produce paper, it needs to be applied. And who applies are the companies (...). This approach is fundamental. There is no way we want to be isolated". University-company cooperation is critical to learning and developing technological innovations [29]. That is, from this interaction, new methods and improvements in products and processes can emerge, and it brings benefits to all parts involved [3].

CLT enabling function

Concerning the enabling function, we seek to understand how the promotion of a collaborative environment that supports and encourages people's learning, feedback, autonomy, and empowerment creates favorable conditions for innovation to be fostered. In Nokia's innovation team, we have identified that its members are empowered to act autonomously in project development - in particular, developers who are directly involved in project execution and the development of innovative solutions. According to respondent 3: “(...) Usually, the senior developer and I have some freedom in the project. We define our activities ourselves. (...) We are encouraged to define how to do it (...)”.

This motivation for team autonomy provides decision-making agility and expands the potential for innovation throughout the project - it makes the team feel confident and motivated for the decisions and discussion of ideas that emerge at meetings. This effect was noted by Gramkow (2016) and like the Nokia innovation team, empowerment was considered one of the driving factors in overcoming the unique challenges of emerging and complex environments [10].

In the researched team, the encouragement of leaders to jointly develop new solutions and knowledge generate a sense of unity, trust, and commitment. The following statements demonstrate that communication and trust among members help the team achieve their goals: “Team tuning is great. (...) Everyone is working together to achieve a goal” (R4). “We work side by side, and we keep a regular conversation. As much as we share the parts of the project, (...) we are always communicating (...), exchanging ideas, and helping each other. (...) I feel that they trust us a lot" (R3). "We can agree, a consensus of everyone together, contributing to a solution" (R5).

Leaders played a key function in building the commitment of the team members. To a large extent, this commitment was achieved by building interpersonal relationships based on trust and unity. These aspects are emphasized by Ott (2010) and Delia (2011), who emphasize the importance of promoting collaborative work, in which leaders are fundamental in taking the team to a higher level to make them more aware and prepared to face challenges and generate a learning and innovation environment.

A feedback culture is an important element in the enabling function. Plainspoken and open feedback is highly valued and significant for developers directly involved with the project because through feedback, they are aware of what needs to be improved or modified during the project. According to respondent 3: “Usually, there is no right date for this feedback (...) it is according to the development of the project (...). Sometimes the head coordinator/Nokia brings feedback from Nokia on how the project is doing and how they're analyzing the project and its progress (...)”. Respondent 5 adds: “We have weekly meetings, every Wednesday, for feedback, (...) so we can understand the timing of things (...)”. Feedback given to members is a way of stimulating the team as a whole and reinforcing an environment of transparency and trust needed for the effectiveness of highly complex projects [12].

Another contribution to the successful performance of the enabling function was the learning incentives. Team members received different training and support from project coordinators. In particular, the senior developer expressed satisfaction with the learning incentives: “We have a lot of internal courses offered by Nokia (...)” (R4). Learning incentives are associated with the idea that the search for new knowledge should be the natural way in an innovation team, and that the environment can be a facilitator of the processes of creating new solutions: “Constant acquisition of knowledge and improvement is part of the normal development process in an R&D team (R2).

The intertwining of the CLT function

In the innovation team studied, it was observed that leadership functions are intertwined, even to meet the challenges faced by the team. This aspect has been identified in other studies that have also addressed project teams in complex environments [9][12]. An example is when the horizontal structure (administrative function) contributes to the emergence of flexible, collaborative, and interactive work processes (adaptive function, which

creates a favorable environment for learning and innovation to be fostered within the team (enabling function).

Another example is the weekly meetings. All weekly formal meetings (administrative function) are dynamic and interactive (adaptive function) and create an environment where the discussion of ideas takes place smoothly (enabling function), which facilitates problem-solving, promotes team learning, and makes innovations more effective (adaptive) function). The most typical case of the intertwining of functions is the import and use of devices under the LTE-M and NB-IoT protocols. Before the team received the LTE-M protocol, the product was inaccessible for weeks due to bureaucratic issues. It caused a delay of almost one (01) month in the project (here, it is observed that the administrative function has involuntarily generated a negative impact on the project).

Subsequently, when the team had access to the device, they found that it did not support the LTE-M protocol, contrary to what had been stated by the providers. Nokia initially brokered with suppliers (administrative function), but then developers took over negotiating and finding solutions with suppliers (adaptive function), adopting an empowered and autonomous posture (enabling function) (Respondents 3 and 4). Finally, they were able to update the software and started using the LTE-M protocol on the device.

Regarding the second protocol (NB-IoT), all respondents made it clear that its incompatibility with Nokia software meant that everyone had to work harder on their functions and interact more (enabling function) to find a co-solution (adaptive function). That is, the coordinators had to take the enabling function over, seeking partnerships with other teams within PUC-PR and Nokia, to jointly find possible solutions (adaptive function). All these articulations occurred synchronously and interconnected through meetings and videoconferences with overseas supplier teams (enabling function). Until the conclusion of the present study, the device was still incompatible with the second protocol.

In the case of protocols, it can be stated that the administrative function contributed both to accelerating and slowing down the development process, generating positive and negative impacts at different times. The positive impact comes from the support of both Nokia and PUC-PR so that the innovation team can solve the problem of incompatibility of the NB-IoT protocol with Nokia software. On the other hand, red tape issues negatively impacted the execution of the project. This scenario demonstrates the importance of understanding the functions of complex leadership in an imbricated way because only then it is possible to understand their influences on project development and the generation of learning and innovation.

V. FINAL CONSIDERATIONS

The present research sought to understand how leadership processes occur in Nokia's innovation team from the prism of CLT. The use of a qualitative methodology, with in-depth interviews with each member, allowed researchers to understand how leadership processes occur and emerge in a specific innovation context through the CLT functions: administrative, adaptive, and enabling.

Although there is a hierarchical relationship between the members of the team, the administrative function of leadership, many times, occurs in a distributed way, that is, depending on the problem, the one with the highest technical competence leads the process. When an innovative idea comes up, it is soon shared among all members and refined in meetings, generating new learning and innovation in the team. The university-company interaction (Nokia and PUC-PR) acts as a facilitator for idea generation and innovation. There is a strategic alignment between the project team and Nokia's strategic level as the project executive coordinator interfaces with the company's strategic group.

Regarding the adaptive function, some examples of learning and innovation that required team flexibility to promote design changes and solve problems were identified. In these situations of adaptation and problem solving, interactions with other areas for idea generation emerge. During the project, interactions were made with teachers from different areas at PUC-PR, and with other internal and external CASs.

Concerning the enabling function, team members are empowered to act autonomously. This empowerment increased agility in decision-making and improved the effectiveness of innovation processes throughout the project. The team grew in confidence and motivation to make decisions and discuss new ideas.

During the project, the coordinators (technical and administrative) were constantly available to dialogue and develop solutions together, sharing knowledge and seeking new ideas. An environment has been created to allow open discussion of issues, and any team member can give their opinion freely. Feedback culture was considered one of the key foundations for creating an environment of transparency and trust. In this environment, learning incentives motivate team members to continue to invest their time and effort in achieving project goals.

Thus, the results identified allowed us to understand how innovation occurs in Nokia's innovation team when through the lens of CLT. Finally, we identified that leadership in the project studied is a collective process that takes place in a complex context in which the quality of relationships and interactions among individuals (leaders and followers) was fundamental to improving the quality of innovation-related processes. Previous studies have demonstrated this, but the present research has advanced, in particular, in understanding the leadership process in an innovation team, which is linked to two organizations of different natures.

ACKNOWLEDGEMENTS

Acknowledgments: This work was carried out with the support of the Fundação de Amparo à Pesquisa e Inovação do Estado de Santa Catarina (FAPESC), through resources from the Public Call Notice FAPESC/CAPES Nº 21/2021 – Accreditation of Higher Education Institutions with emerging stricto sensu graduate programs and being consolidated in priority areas in the state of Santa Catarina, Termo de Grant CP 21/2021 FAPESC.

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