A puzzle to incorporate and share learnings in a scaling venture builder

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Management Summary

The problem statement addressed in this report has been validated by NLC employees, who recognize that *the company should better incorporate and leverage the knowledge which has been generated from the organization activities*. By scaling, it is becoming complicated to capture, share and retain knowledge. New Customer Relationship Management systems are being progressively incorporated with the purpose of improving management of relationships data and leads information. However, a considerable amount of **actionable knowledge** is not yet collected or is confined within people. The latter is certainly not an issue per se, but the risk associated is that the distance between people of different teams and high-turnover positions interfere with the integration of learnings at the relevant level of the organization.

NLC aims to continue being a **learning organization**, overcoming the challenges that scaling implicates, because aware that knowledge is an extremely valuable asset that, despite its intangibility, is worth a competitive edge on the market. NLC long-term operations' **efficacy** is directly proportional to the ability to record the ecosystem's feedbacks and steer appropriately.

I investigated how learnings relevant to NLC are currently generated and incorporated at three different levels: **teams**, **organization** and **ecosystem**. I mapped where and how the organizational learning processes occur in the company and I identified what practical knowledge is needed at different levels to facilitate the team activities. Finally, I ideated a **scalable model** to store and transfer knowledge effectively in the organization.

The current **situation** is that NLC has the potential to further leverage the knowledge obtained from past experiences. However, the **complication** is that the knowledge present in the organization does not reach collective awareness. The **key question** that NLC wants to solve is "how to build a learning organization able to define meaningful targets".

By interviewing 24 employees, I identified 9 improvement points:

- Tacit knowledge
- Awareness of data generated
- Accessibility to data available
- Post-action reflection
- Data capturing
- Data usage
- Feedbacks establishment
- Internal benchmarks establishment

- Alignment and coordination

Starting from these improvement points, I ideated a tool that serves to track the switch in the collective knowledge state, and to incentivize the behavioral process that aim to achieve team learning. The solution that I ideated is a gamified knowledge management system named **PuzzLearn**, which will support the Wiki initiative of the IT team. The tool will allow the learning culture of NLC to self-sustain and grow, similarly to the flywheel effect. The principle of PuzzLearn is that *the demand of knowledge creates knowledge itself*. The system expects people to collaborate, exchanging knowledge in order to progress with the puzzle. Transferring knowledge with a human (virtual) interaction, the meaningful information discussed are automatically transcribed and stored in the company databases, allowing people to use the **knowledge on-demand**. The knowledge collected by these interactions will likely be redundant, and the community of users rating the quality of information will help the Wiki selecting what to display to the user's Wiki-query, combining the most valuable pieces of information.

I believe that NLC will benefit from the adoption of PuzzLearn because it would improve its ability to *become sensitive to the ecosystem response*. Early sensing capabilities are developed by **integrating the feedbacks** to actions taken in the venture building process. The integration of feedbacks helps decoding the NLC-ecosystem interaction and allows to **adapt** and **steer**. Everyone in the company should not lose the big picture as the organization scales so that all departments are aware of what is needed to reach a meaningful target. This would be ensured by sharing knowledge gained from experience to people who can echo relevant information to the right teams and people.

Company profile

NLC was founded in 2015 in response to the observation that the vast majority of **health-tech innovations** patented every year do not reach the patients. NLC builds ventures licensing intellectual property (IP) assets from universities, obtaining patents de-prioritized by corporates, and developing software solutions that solve unmet medical needs. The business model is developed on top of a shared mission, *bring science to life*, that focuses on a niche of innovations that would not otherwise impact the lives of people who need them the most. The venture building capabilities of NLC are the result of a high-quality **due diligence** on innovations, in which the **network** is leveraged to ensure that experience and expertise have a central role in decision-making. Once the IP and the business case of the innovation meet standardized criteria, NLC starts building the venture licensing the IPs on behalf of the venture and hiring an appropriate CEO. The ventures built can rely on NLC support from fundraising to strategic business decisions.

Investments in health-tech early-stage technologies are obviously high risk because results available are generally pre-clinical, and a competitive complete team is not in place yet. However, in the past 7 years NLC developed a set of skills and processes which de-risk the investments, keeping alive most ventures built so far.

Before analyzing the company strategy and core processes in depth, it is useful to visualize the company entities (Fig. 1), dissect the context in which NLC is operating and describe target geographical areas.

NLC International BV is the holding company, which is the entity where the shareholder's money are sitting (Management Report, 2022). 65% of NLC International BV shares are owned by individual shareholders, whereas 35% of shares are owned by employees as part of their remuneration package, to make sure that interests are aligned. NLC International BV owns 100% of **NLC Ventures Netherlands BV**, 100% **of NLC Management BV** and 100% **NLC Fund Management BV**. NLC Ventures Netherlands BV is the company where most of the employees are registered (I will refer to it as simply NLC), and has a two-tier governance, in which the supervisory board oversees the executive management. NLC Management BV was set up to provides management services to ventures in which the right CEO has not been hired yet, however, is not playing a key role in the company strategy. **NLC MSB BV** is a sub-holding entity of 7 ventures, set to realize cash-inflow for NLC Ventures BV. One of these 7 ventures, Retinacheck, achieved an exit and another one, Oval Bone Saw, was discontinued. NLC Fund Management BV, where some employees from the venture finance team are registered, acts as fund manager for the captive funds established: **Stepping Stone Fund** and **Health Impact Fund**. The Stepping Stone Fund provided 100k EUR of initial investment in ventures built, as a first convertible loan investment. The Health Impact Fund is a fund of 100M EUR capital which is expected to finance impactful healthcare solution starting from 2023.

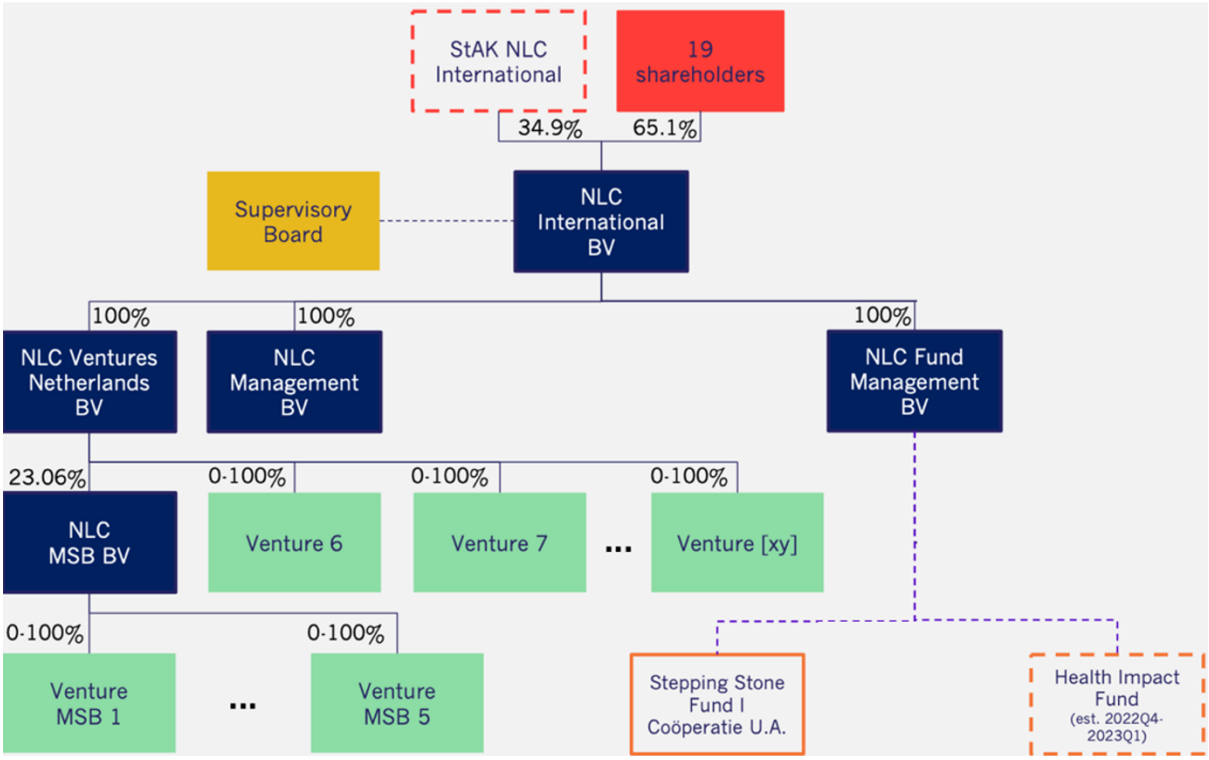

Fig. 1. NLC organigram.

NLC used to focus exclusively on European technologies which impact the healthcare systems worldwide. As the company is scaling, the geographical focus is expanding, with experiments that are currently being run in the USA and Israel. To date, NLC Ventures Netherlands BV has built more than 100 ventures, and ~80% of them are still alive and actively fundraising or selling their products. **Financial return** and **impact** are equally important for NLC; the technologies need to generate financial return by making positive impact on either patients, society, planet and healthcare workers in order to be considered.

NLC's organizational structure is flat and organized to promote a "one team approach". The core values of NLC are **TO-DO**, which stands for: Together, Open, Decisive and Optimistic.

Domain division and clusters

The health-tech ventures built by NLC can be classified into 4 domains: **medtech** (47 active ventures), **biotech** (12 active ventures), **digital health** (14 active ventures) and **green health** (1 active venture) (Data collected in Q3 2022). The domains are divisions inside the venture creation team, which will be introduced in more details in the *Teams* section of this chapter. The first domain established was medtech, specialized in medical devices, which built more than 60% of currently active ventures. The digital

healthcare domain, specialized in medical software solutions, has been recently incorporated into medtech as a specialized cluster, because a lot of hardware medical devices have a software component and therefore the recombination of expertise generates synergies in the due diligence of new technologies. The biotech domain, specialized in biopharmaceuticals, has historically operated more independently because of different market evaluations. Finally, the green health domain started as an experiment and, after building some ventures in 2022, became a cluster integrated in the medtech domain. NLC's domains don't have net separations, the goal is rather to have compartments with different technical skills that can make a collaborative effort to learn from each other and increase the output of the organization.

Incorporated into the medtech domain there are two clusters, in addition to the digital, that are specialized in specific innovations: **musculoskeletal** (MSK) and **cardiovascular** (CV). The clusters are composed of two Venture Developers (VDs), one Venture Partner (VP) and a **panel of experts** operating in clinics or with commercial experience in the area of reference. The roles mentioned will be introduced in the *Teams* section of this chapter.

Core process

The pipeline developed by NLC to assess inventions, internally called leads, consists of six steps (Fig. 2)

- **Sourcing**: technology inflow
- **Scouting**: high-level due diligence and investment proposal evaluation
- **Selection**: detailed due diligence and term-sheet with IP-holders
- **Formation**: CEO finding
- **Building**: start the venture and support it
- **Transfer**: exit is achieved by selling shares

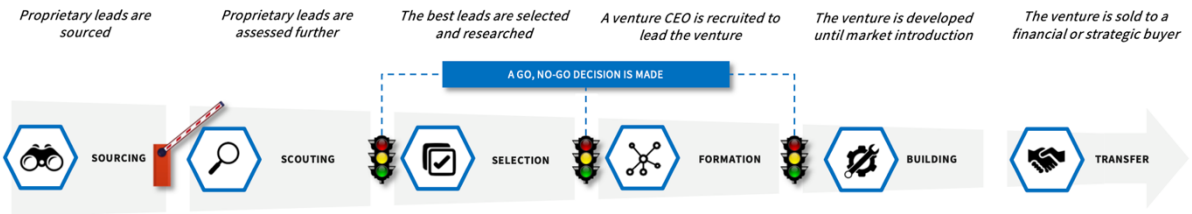

Fig. 2. NLC's core process.

The core process of NLC is **agile** because the investment proposals for all technologies sourced, before reaching the building phase, are reviewed sequentially after a solid and complete business case is developed. In each of the three gate-keeping steps, scouting, selection and formation, details and feedback from stakeholders are incorporated, refining the business case. The go/no-go decision is made after evaluating

the investment proposal: **Selection Investment Proposal** (**SIP**) to move a lead to the selection phase, **Formation Investment Proposal** (**FIP**) to move a lead to the formation phase and **Building Investment Proposal** (**BIP**) to move a lead to the building phase. Once the employees involved in the evaluation of the investment proposals agree that the business case is solid enough to move to the following stage, the lead moves forward to analyze in depth what still needs to be addressed in terms of deal terms, return on investment, or technical challenges. The iterative process lowers the risk of mistakes and improves the detail of the proposal, until the foreseeable risks have been determined to be acceptable. Once the lead is in selection, the first **term-sheet** is negotiated with the IP-holder. The terms vary according to the individual case evaluations, however, NLC is generally the **majority shareholder** because the services provided to the venture are remunerated with equity instead of liquid payments, so that interests are aligned and NLC has *skin in the game*. Once an agreement is found on the term-sheet, the lead moves to formation and the most appropriate CEO for the venture is hired on an equity-based remuneration, until first financing round, to make sure that also the venture's executive management interests are aligned. Once the venture is built, the kickstarter program takes place and the CEOs are onboarded in the venture by the venture support team who provides them with information about regulatory, market access and financing strategies.

Teams

Venture Creation

During my internship at NLC, I was part of the **Venture Creation** team in the digital cluster of the medtech domain as a venture developer. The venture creation team is composed of **Venture Developers** (**VDs**), **Venture Partners** (**VPs**) and **Technology Assessment and Strategy** (**TAS**). Venture Creation is responsible for the **due diligence** on promising leads. VDs have technical background in life sciences and build a business case together with VPs, who are often senior employees with managerial, entrepreneurial and leadership records in health-tech. VPs have the ultimate responsibility for the lead development. Each VD is teamed with a VP on individual leads. The IP claims and technical feasibility are assessed by TAS, who are specialized in patent assessment and have relevant technical experience.

To further explain the due diligence process, I will illustrate the pipeline with an example of a *cold lead*. The main difference between a *cold lead* and a *warm lead* is that the warm lead gets to NLC via account management practices and leveraging an existing, or established relationship with universities and **Technology Transfer Offices** (**TTOs**), whereas the *cold leads* are generally IPs which are offered to many parties by the TTOs of universities to be licensed.

If the cold lead addresses an unmet clinical need with a good **problem-solution fit**, the VD starts contacting the inventing team and TTO to ask questions related to the

invention, such as **Technology Readiness Level** (**TRL**), what is needed to further develop the product, and how the team envisions a venture starting from their project. Often, a **Non-Disclosure Agreement** (**NDA**) is required to be signed by both parties in order to discuss the technology in detail. After the inventor and TTO have been contacted, the VD updates the VP and together they agree on the steps needed to continue the due diligence. Typically, the VD contacts **experts** who are part of the NLC network to assess the unmet clinical need, get insights about market trends and evaluate the technical feasibility of the inventing team's plan. While collecting findings from conversations with experts and desktop research, the VD writes a Selection Investment Proposal (SIP) to discuss the business case together with a VP and a TAS member. The SIP contains information about the technology and its competition. The VD also presents a **Back of the Envelope** (**BoE**) to a member of **Venture Finance** (**VF**) team. The BoE is a projection of the Total Addressable Market (TAM), market share expected to gain, investment needed for product development, clinical trials and additional regulatory requirements required to market the product. In case both the SIP and BoE confrontations have a positive outcome, meaning that there might be only few **Riskiest Assumptions**[1] (**RAs**) to be clarified, but the overall business case seems solid, the lead is moved to selection. Otherwise, the VD will provide feedback to the inventing team on why the technology does not fit with the NLC model or what further information is needed.

Once the lead is moved to selection, the VD and VP go back to the inventor to discuss more in depth what are the terms of the deal in case they want to continue with NLC, and elaborate more on technical and financial details, writing the Formation Investment Proposal (FIP). When the term-sheet and FIP are approved, the CEO recruitment process of **Venture Teaming** (**VT**) starts. Finally, once the CEO discusses the terms and is hired, the Building Investment Proposal (BIP) and the venture one-pager[2] are submitted to multidisciplinary reviewers, who will finally decide to move the lead to building.

Venture Support

The **Venture Support** (**VS**) team provides a wide range of services to support NLC venture portfolio and supervises the ventures' kick-starter program. VS is responsible for creating a network of CEOs in which they can capitalize on previous learnings and help each other with operational issues encountered. Three key areas are addressed by the venture support team: **proposition development**, **organizational development** and **venture protection**. To do that, members of the VS team have technical background, and in some cases are specialized in critical areas such as healthcare regulatory operations and clinical trials design. Additionally, the VS team is responsible for the **quarterly**

[1] Riskiest assumptions are dealbreaker assumptions that can make the business case collapse.
[2] The venture one-pager is a document that highlights the main features of the venture (technology information, market targeted, etc.).

review cycle of ventures, identifying where support is needed to optimally develop the NLC portfolio.

Venture Finance

The **Venture Finance** (**VF**) team ensures that ventures in portfolio have sufficient capital to run their operations, leading on a venture's behalf the dilutive/non-dilutive financing rounds. Additionally, the team supervises NLC's **captive funds** with active fundraising and fund management activities. Finally, VF is responsible for negotiating deals with exit partners.

Data and Analytics

The **Data and Analytics** team is responsible to **collect**, **organize** and **process** data generated by NLC operations.

Legal

NLC's **Legal** team is involved in the NLC core process at all stages. The team is responsible for **NDAs**, **term-sheet agreements** with IP-holders, **corporate governance**, **human resource contract management** and **legal compliance**. Additionally, the legal team offers support and tailored consultation services to the ventures in portfolio.

Tech Partnerships and Marketing

The **Tech Partnerships** team is responsible for **technology sourcing** and **building relationships** with corporates and universities. In particular, the team develops relationships with corporates with the aim to find exit partners or to collaborate on projects with shared equity. **Marketing** is a new team generated as part of the Tech Partnership team and is currently hiring new employees, such as a Chief Commercial Officer and ancillary figures to communicate NLC mission and develop opportunities for core activities.

Expertise Integration

The **Expertise Integration** team is composed of employees with experience in clinical practice (e.g., medical doctors). The team is responsible to **integrate clinical experts** in the network of NLC, for instance, by finding the right experts for a specific cluster inside a domain.

IT

The **IT** team takes care of the internal **digital infrastructures**, making sure that all systems in the digital environment are integrated and as automated as possible. The

team is also responsible for updating and fixing issues with the proprietary algorithm which contributes to source technologies from scientific articles published in peer-reviewed journals. Also, the IT team is capable of building in-house software solutions to facilitate core activities.

Venture Teaming and People & Culture

The **Venture Teaming** (**VT**) is the Human Resources (HR) team at NLC. Team members are responsible for **internal hiring** and **ventures talent selection**. VT adopts digital tools that allow the coordination of employees from different teams when interview rounds are scheduled to select the best CEO or candidate for internal positions. The VT team works closely with the **People and Culture** team, which is responsible for the **company culture**, **transparent communication** (e.g., salary and bonuses), **people management** and **professional development opportunities**.

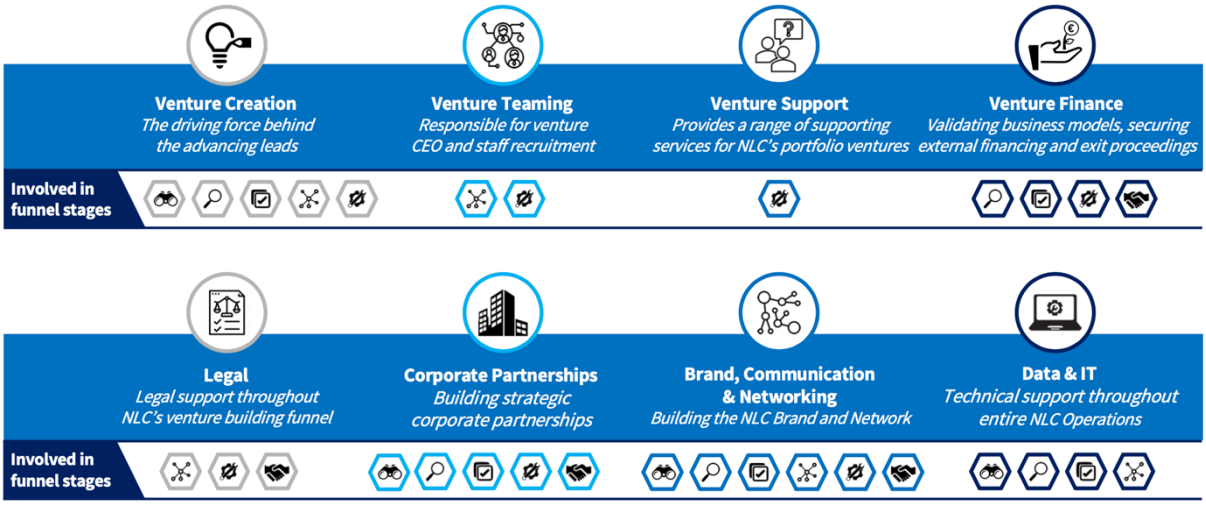

Fig. 3. NLC's teams.

Core capabilities

- **Network**: NLC's presence is strong not only in the Netherlands but in the whole European health-care ecosystem. Currently, borders are expanding also in the US and Israel. The network is composed of inventors, corporates, clinics, advisors, universities, investors and experts. The network is one the most valuable intangible assets of NLC.
- **Due diligence**: this hard skill is the result of the recombination of individual technical skills (legal experience, life science knowledge) and network, because experts play a key role in the process of evaluating new leads' potential.
- **Entrepreneurship**: this personality trait is present in all NLC employees. Entrepreneurship requires risk taking, an optimistic mindset creativity and the

ability to put together pieces of information which ultimately build a business case.

- **Fundraising**: this technical capability is present exclusively within the VF team. NLC and its ventures benefit from it, supporting ventures in financing rounds and making sure that NLC can do successful fundraising for its funds and scaling processes.
- **Support**: this capability is possible from the combination of soft skills, such as empathy, and technical skills, such as the knowledge of different healthcare systems in Europe and different regulatory pathways around the world. The ventures and ventures' CEOs benefit the most from it.

Porter's five forces model

Fig. 4. Suppliers, buyers, new entrants, competition and substitutes in NLC ecosystem.

In NLC's business model, **suppliers** are entities that actively contribute to the inflow of technologies developing IP assets that can be licensed or assigned. Technologies are sourced from universities' TTOs and corporates. There are two stakeholders involved when dealing with universities: **TTOs** and **inventors**. Generally, inventors aim to further develop their inventions by accessing capital and receiving the management support needed, whereas the TTOs are mainly interested in financial return from the deal over the IP asset. Corporate relationships are different, in fact there are different levels of collaboration (e.g., build to buy, joint ventures, etc.). The **bargaining power** of suppliers is generally low because early-stage technologies are high risk and not many entities invest into that, leading to deals in which NLC is the majority shareholder.

NLC business model relies on exits as a major revenue stream. In the health-tech domain an exit is expected to be achieved on average 10 years after the venture is established (Cairns E., 2019). Exit partners, **buyers**, can be strategic buyers or financial buyers. NLC identifies before building the venture what the market needs are and who can be the right partner for the exit. While the venture develops, more potential partners can be involved so that the negotiating power ends up being in NLC's hands. So far, NLC achieved two

partial exits (NicoLab) and one complete exit (Retinacheck). The **bargaining power** of buyers is high because the competition is massive. Strong relationships with buyers and a development of strong IPs can make the difference in making strategic deals.

Considering the size of the healthcare innovation market, **new entrants**' threats are concrete. However, in order to develop a proposition that competes with NLC, there are two main barriers to consider: **network** and **learnings**. The network of NLC consists of strong relationships with Dutch clinics (due to expertise integration), reciprocal trust with corporates such as Philips and Medtronic (because many NLC employees had commercial and management roles there) and a record of collaborations with many European TTOs. For a new entrant to establish this network there are two possibilities: build it from scratch (it would take a considerable amount of time and money) or hire people with a similar career. Finally, NLC learnings took 7 years to get collected and implemented, therefore a new entrant would need to have similar experiences to coordinate operations similarly to NLC. The more NLC leverages the learnings generated so far, and the more learnings are generated, the more difficult it would be for a new entrant to compete. Nonetheless, a new trend that can threaten NLC business model is the increasing entrepreneurial awareness in academic environments. For this to happen, a cultural shift in academic researchers must occur, and it could take a very long time. This shift has been documented as a **liminal venturing framework** (Hayter C. S. et al., 2021). Since incubators/accelerators are interested in the combination of team and technology, they are starting to provide university inventors with the tools to validate their proposition and develop an entrepreneurial approach. However, the aim of NLC is to target innovations that wouldn't reach the patient otherwise, and the pool of these innovations is massive.

NLC can be classified as a **tech-transfer studio** (Blank S., 2022), and there are very few **substitutes** in Europe operating as such in the medtech domain. In fact, NLC's Unique Selling Proposition (USP) is the combination of investing in early-stage technologies and providing access to a platform of support that connects experts, CEOs, corporates and investors.

In terms of **competition**, healthcare funds and startup support entities can be considered as NLC competitors (or not) according to the feature used to cluster the companies operating in this space (e.g., investment stage, services provided). For example, if the discriminatory variable is the **amount invested** from captive funds, then NLC competition would consist of pre-seed investors (e.g., Utrecht Health Seed Fund, Lumo Labs, Red Medtech Ventures) and incubators/accelerators (e.g., UtrechtInc, Yes!Delft, Healthinc), because NLC's captive funds provide the ventures with an initial investment of 100k-150k EUR. If the focus shifts to the **TRL** at which the funds invest, then the competition would be only pre-seed investors. In case the focus is the **support system** provided by NLC, the competition consists of healthcare consultancy firms (e.g., Catalyze, IQVIA) or incubators.

Research Question

When I joined NLC, on September 1st 2022, **Project Flywheel** was mentioned as the crucial next step for the company in the first Zoom meeting I attended. Asking around what the project was about, I couldn't collect any informative detail at that time. I couldn't understand the direction that NLC would take with the project. Answers were generally broad, it seemed like anything could be part of Project Flywheel. In fact, during the first week at the office, the executive management asked to every NLC team to imagine how NLC could maximize the value it generates, without considering budget limitations or geographical focus areas. I participated to a brainstorming session in which all components of the medtech/digital healthcare team were thinking of strategical approaches to increase the value generated by NLC. All employees, no matter the position, could actively contribute to design NLC future. Eventually I found out that Project Flywheel is the plan that NLC will implement to successfully scale and grow, and details were yet to be determined. I thought it was an exciting time to be on board.

I immediately thought that understanding how the company would reorganize to scale would be an interesting and ambitious research question. I soon realized, however, that NLC won't design any rigid strategy to define the future, but instead the strategy is a **dynamic response to learnings** derived from the company's actions. The core of this approach is to **steer** when necessary, being open to change direction when external factors affect NLC activities and being able to identify successful operations and build on top of them. The abstraction of the dynamic response to the consequences of actions is **reinforcement learning**, model inspired by the evolution of biological systems, which is achieved by introducing genetical, or behavioral, *changes* in response to the environmental *selection* and *retaining* the features that collected positive feedbacks from the environment (Donahoe J. W. et al., 1993). The company influences, and is inevitably influenced, by the health-tech ecosystem. NLC long-term operations' efficacy is directly proportional to the ability to record the ecosystem's feedbacks and steer appropriately.

I firstly volunteered to keep track of operational experiments that NLC would run with the aim of improving Venture Creation processes, to extrapolate learnings from them and contribute to the company growth. At that point, something was already happening in the company: I took part to a meeting in which some employees from the Venture Creation team proposed an innovative process for the Selection Investment Proposal (SIP) evaluation. The idea consisted in structuring the SIP assessment in a 30-minute conversation in which technological and financial details are discussed. In this way, the Venture Creation team would operate in small group units in which people with different capabilities recombine their critical approach to build more complete business cases, increasing the elegance of thoughts, and focusing on how to make innovations work, trying to address all Riskiest Assumptions (RAs). With this format, Venture Developers (VDs) would provide all the information collected about the technology and

the investment to Technology Assessment and Strategy (TAS), Venture Partner (VP) and Venture Finance (VF), so that all components would contribute to build the business case during an entrepreneurial conversation, as opposed to the previous methodology consisting of commenting on shared documents in a Google Drive environment.

I was enthusiastic to collect data about the comparison of the two SIP evaluation approaches because I wanted to prove that this approach is a crucial improvement for Venture Creation, because it would allow to **standardize an entrepreneurial approach**. By identifying the number of leads that a Venture Creation unit can evaluate in a year, and the average conversion rate of the leads going forward in the pipeline, it is possible to derive the number of units necessary to build the target number of ventures per year. However, my excitement and excessive optimism decreased when I started analyzing the company data: only then, I realized that I could not produce a significant analysis on the implication of this process due to the limited time of my internship. Overall, it takes around 9 months to build a venture from scratch, and my internship lasts only 6 months, making it unfeasible to monitor the output of the new process. Therefore, I decided to pivot my initial idea, focusing this time to identify how actionable knowledge is collected and utilized in the company.

The problem statement that I addressed in this report has been validated by NLC employees, who recognize that ***the company should better incorporate and leverage the knowledge which has been generated from organization activities***. By scaling, intended as increasing in size and ventures output, it is becoming complicated to capture, share and retain knowledge. New Customer Relationship Management (CRM) systems are being progressively incorporated with the purpose to improve management of relationships data and leads information. However, a considerable amount of **actionable knowledge** is not yet collected or is confined within people. The latter is certainly not an issue per se, but the risk associated is that the distance between people of different teams interferes with the integration of learnings at all levels of the organization. Also, the turnover of people is a concrete obstacle to develop specialized knowledge in the clusters and to build on top of pre-existing knowledge.

NLC aims to continue being a **learning organization**, overcoming the challenges that scaling implicates, because aware that knowledge is an extremely valuable asset that, despite its intangibility, is worth a competitive edge on the market. The learning organization: (I) **remembers** and **learns**, (II) **applies** learning to produce and/or **modify** dispositions, policies and processes, (III) **targets** communities by tailoring principles in a scalable way, and (IV) **believes** that the learning process can benefit from synergies, making it greater than the additive sum (Levine L., 2001).

Organizational learning is a practice consisting of: (I) shared insights, information and mental models (allowing reasoning about situations not directly experienced) (Gentner D., 2002), of members of the company, and (II) organizational

knowledge building on top of organizational memory (e.g., policies and strategies) (Marquardt M.J., 2002). Organizational learning happens when there are processes in place to transform tacit knowledge into **explicit knowledge**, allowing people in the company to use it for decision-making purposes (McInerney C., 2002). Organizational learning is the mean to reach **sustainable growth**. The organization needs to ensure that individual teams continuously learn from NLC operations. Additionally, learnings that are relevant for decision making need to be efficiently processed into easily accessible information. The more team members have access and utilize as a collective the knowledge generated from past operations, the more the organization can keep track of its relationship with the ecosystem, monitoring its feedbacks to NLC actions, and co-evolve with it.

Three types of organizational learning have been described in literature: **adaptive learning, anticipatory learning** and **action learning**. As described in "*Building the Learning Organization*" from M.J. Marquardt, **adaptive learning** moves from action, to outcome, to evaluating the congruence with the goals, and finally to reflection. In the NLC context, I believe that this framework is adopted by the management board to monitor team performances. Also, it could be helpful for the Venture Creation team to identify the verticals, within a cluster, that are worth to pursue or abandon. On the other hand, **anticipatory learning** moves from vision, to reflection, and finally to action. This form of learning induces the staff to be proactive, reflective and creative by anticipating future scenarios and making sure to be equipped with the resources that will be needed. At NLC, this framework is applied, to some extent, by the individuals participating to the investment proposal discussion (as it will be illustrated in the *Results* section). Lastly, **action learning** is a dynamic learning framework that allows the company to respond faster and more efficiently to changes. This learning is achieved while solving a problem in team, focusing on existing knowledge and being reflective on feedbacks throughout the process. Action learning can be summarized as the process of pausing experience to process its meaning, planning future actions which will again generate experience (Cho Y. and Egan T. M., 2009).

In literature, learning, in the context of teams and organizations, has been documented as both *learning as a process* and *learning as an outcome*. Team/organizational **learning as an outcome** refers to a change in the team/organization's collective knowledge state (Ellis et al., 2003), represented by the transition of knowledge which instead of being held by an individual, is offered to the **collective entity**. Despite proxies developed to monitor this transition, it is extremely hard to monitor when knowledge transitions from an individually-held property to a team/organization-held property (Wiese C. W. and Burke C. S., 2019). However, the majority of works published conceptualize team/organizational **learning as a process** happening over time, fueled by **behavioral processes** that eventually establish a collective knowledge. In this work, I ideated a tool that serves to track the switch in the

collective knowledge state, *learning as an outcome*, and to incentivize the behavioral process that aim to achieve team learning, *learning as a process*.

My **hypothesis** is that a practical and scalable knowledge management system could be a valuable tool to achieve a **collective learning** at the team and organizational level, finally improving the quality of decisions taken in the venture building process. In a company environment it is not intuitive to interpretate the feedback from the ecosystem, because the consequences of key operation are rewarded/penalized only at the end of the process. More concretely, in case of NLC, the success of processes aimed to build a strong business case are rewarded only at the end, when the venture built conducts successful fundraising and develops the product bringing it to the market. Similarly, when learning to play chess, it is hard to tell whether a single move increases/decreases the chances of winning the game, because the player receives binary feedback only at the end of the game (Brunton S. L. and Kutz J. N., 2017). For this reason, it is crucial to develop metrics to monitor and collect early feedback from the ecosystem, in order to reinforce/punish the actions and be prepared for steering, if needed. The challenge is to define a policy (π) of what actions (a) to take, given a state (s), to maximize the chances of getting future reward (r) (Fig. 5). In machine learning, this concept is called **Q-learning**, which is a reinforcement learning strategy in which the value of decisions is learned from experience.

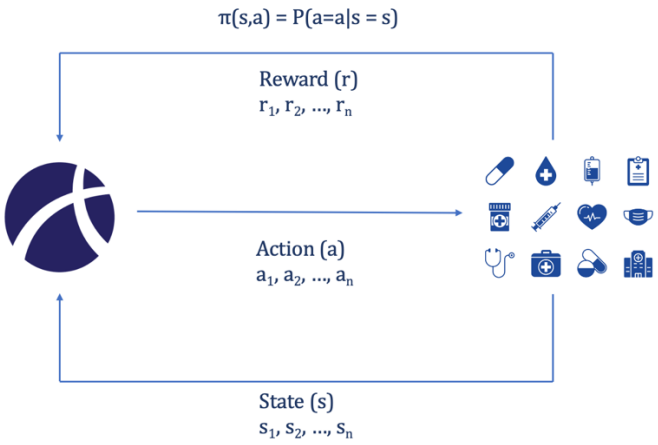

Fig. 5. Reinforcement learning model.

The value of each state (s) of the system, given a policy (π), is the expectation of reward in the future, starting in that state and enacting the policy. It is necessary to develop **markers** to *decode early rewards or punishments*, by recognizing a certain state (s) being favorable (or not) and therefore increasing chances of getting the final reward. Important to consider in this model is that the environment also changes, and NLC is not the only player in the medtech ecosystem. Identifying what are the good actions and bad actions that will eventually in a certain state is not easy, but it is the key to sense changes early enough to adapt.

In this report, I investigated how learnings are currently generated and incorporated at three different levels: **teams**, **organization** and ecosystem, providing examples of situations that I lived in first person. These three dimensions are not impermeable, all actions are rather interconnected. However, to facilitate my learnings dissection task I believe it is clearer to approach the three levels separately before drawing conclusions and implications of specific actions on the other compartments. I mapped where the organizational learning processes occur in the organization and I identified what practical knowledge, already collected by the company, is needed at different levels to facilitate the team activities. Finally, I ideated a scalable model to store and transfer knowledge effectively in the organization.

Team

First of all, I dissected the learning experience in the **Venture Creation** team. In fact, being the team multidisciplinary (VF, VP, VD, TAS), I wanted to investigate how individual capabilities are recombined and leveraged. I also aimed to investigate how the singular **clusters** learn, testing my hypothesis that VDs in the cluster can become more experienced in the specific area by quarterly interacting with the expert panel. Moreover, since the team of which I was part of conducted various **experiments** to find additional strategies to build new ventures, I explored how the experiment tracking is done and whether the results are shared with people who can benefit from them. So far, I noticed that a lot of experiments are running at the same time, therefore I identified the need to structure a tracking system and a plan to steer/reinforce after integrating the learnings.

NLC organization

In this section I highlighted the knowledge useful for the whole organization, identifying the **feedback loops** that are not effectively leveraged. For example, I wanted to test my hypotheses that there is a missing feedback loop from **Venture Support** to **Venture Creation**, from Venture Creation to **Venture Teaming**, and from **Tech Partnership** to Venture Creation. Additionally, I wanted to investigate whether **Venture Finance** is the only team aware of what the investors appreciate to see in ventures in which they invest, and what are the critical points that repel them. Something that I realized to be missing are the comparison of the initial projection of the business case and the real investment needed to finance each set of activities (e.g., clinical trials, product development). With this kind of information, I thought that NLC could further structure knowledge sharing meetings, currently occurring monthly as "*teach-ins*", and make sure that the company constantly improve as a one single team in (I) **due diligence capabilities**, (II) **communication with external entities**, and (III) **alignment with different domains**.

Medtech ecosystem

In this section, I investigated at high-level the complex interaction of NLC with the medtech ecosystem, identifying what are the external forces that the company should constantly monitor to feel changes and adapt consequently. A special focus will be on partnerships, trying to identify what are the key learnings from the relationships developed with stakeholders such as **universities**, **corporates**, **clinicians**, **investors**, **ventures**.

At all three levels, I distinguished between different kind of knowledge and how each type can be further leveraged.

Methods

The results generated in this report come from four main sources

1. **Experience**: my role activities and informal discussions with other employees
2. **Qualitative Research**: 30 minutes discussions (~5-7 questions)
3. **Literature**: research of relevant published articles
4. **Consultancy and Design Thinking Frameworks**: to develop the solution

The way the report was structured was by iterating research and combining results coming from the overlap of the four-research methods.

Experience

In my role as Venture Developer Intern, I participated to **investment proposal discussions**, **medtech strategy meetings**, **company general meetings**, **digital cluster meetings**. Additionally, I had informal conversations with employees from all different teams, who enriched my understanding of the company's dynamics.

Qualitative Research

I interviewed 24 people

- 2 Executive Managers
- 2 Venture Developers (VDs)
- 10 Venture Partners (VPs)
- 3 members of the Technology Assessment and Strategy (TAS) team
- 1 member of the IT team
- 1 member of the Data & Analytics team
- 1 member of the Venture Finance team
- 1 member of the Tech Partnerships team
- 1 member of the Venture Support team
- 2 members of the Expertise Integration team

In some cases, I had more than one round of interviews with the same person. For instance, one member of the TAS team is also a VP, therefore I interviewed him/her twice so that I could collect the perspective of the two roles. I interviewed mostly VPs because they are in the lead of the Venture Creation Team. Also, they support the ventures in portfolio, making them the keepers of NLC knowledge, central topic of this report.

Coding

The conversations have been transcribed at the moment that the interview occurred. Each interview was scanned with the purpose of **semantically code** meaningful statements that are relevant for key questions and hypotheses raised.

The semantics keywords used to group interviews' results are the following

- **Inventors' involvement**
- **Venture success**
- **Sharing learnings**
- **Feedback to Venture Creation**

Literature

The report was enriched with key literature with the purpose of strengthening the conclusions of observations generated by direct experience and interviews.

Keywords

Literature was searched mainly on Google Scholar by using the following keywords: *knowledge management*, *organizational learning*, *learning*, *how people learn organizations*, *team learning*, *gamification in organizations*, *venture capital knowledge*, *venture capital specialization*, *venture capital portfolio management*, *action learning*, *knowledge management tools, knowledge sharing, motivation*. Additionally, for specific examples I researched literature using technical keywords (e.g., *open-source software*, *open-source business models*).

Consultancy and Design Thinking Frameworks

During the Utrecht University Business Course (UUBC) honor's program I attended workshops hosted by Accenture to structure problem definition and solution development. I applied these frameworks to develop the solution that I propose to the company.

I started by focusing on what the situation, complication and key question are (Fig. 6), with respect to the initial problem statement of this report: *how to integrate learnings in a scaling organization.* The client, in this case, is NLC.

Situation	**Key facts considered largely indisputable**
Complication	**Why the client needs to consider change (what is preventing them to reach goals)**
Key Question	**The single, most important, question that the client needs to answer**

Fig.6. Situation, complication and key question consultancy framework.

Then, I followed the framework in Fig. 7 to iterate the process of finding results that are relevant for the development of a concrete solution for NLC.

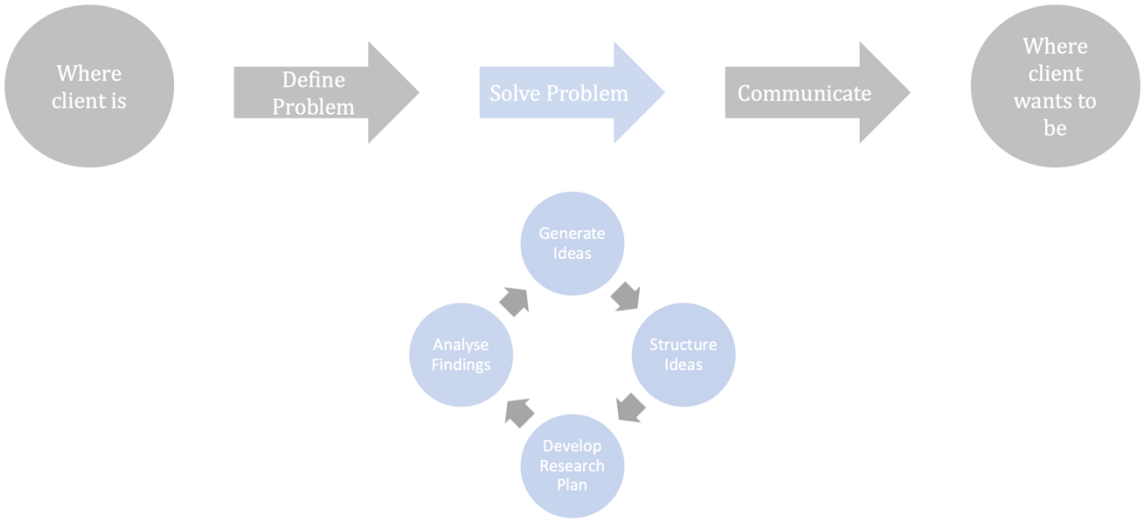

Fig.7. Iterative problem-solving consultancy framework.

Aiming to develop a solution for the company, I followed the **design thinking framework** in Fig. 8.

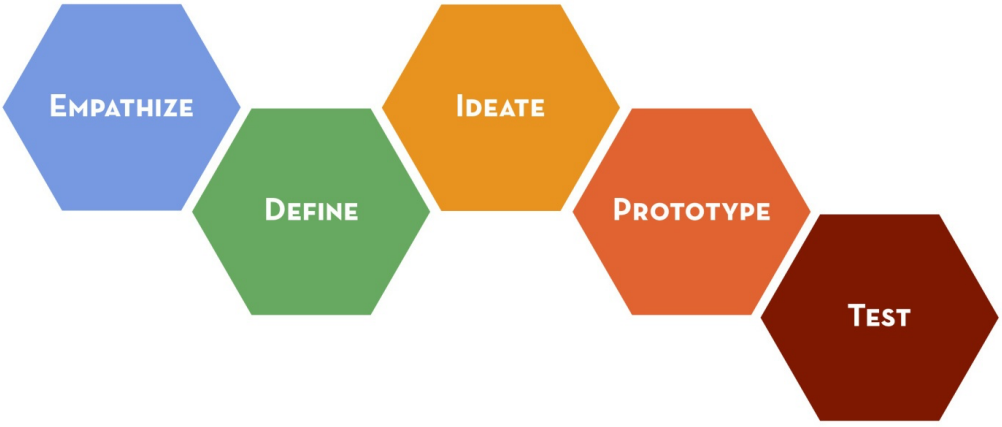

Fig. 8. Design thinking framework (Plank et al., 2021).

Finally, aiming to report the findings to the company, I followed the **pyramid framework** in Fig. 9. Communicating the findings, mainly for the purpose of the final presentation, I started by the top of the pyramid by communicating my **solution** (main message). The communication then developed with "sub"-**key messages** and **evidences** supporting them.

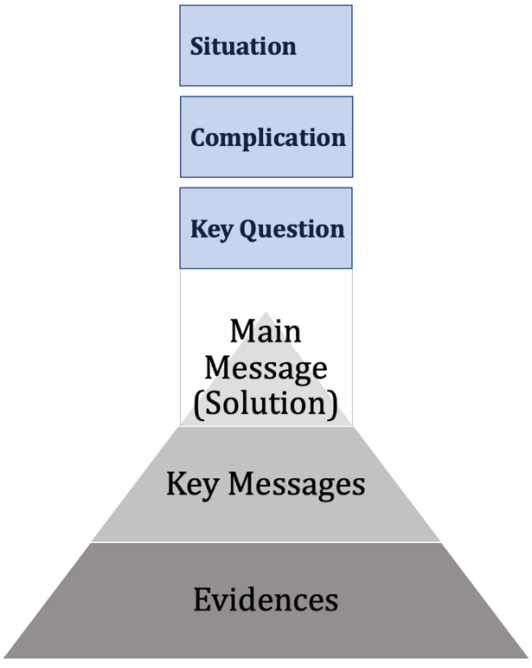

Fig.9. Reporting solution consultancy framework.

Results

NLC is aware that the **knowledge** generated in the past 7 years can be transformed into a powerful **competitive advantage**. Some knowledge management initiatives have started, but at the moment the issue is that NLC could share more learnings at the levels at which this knowledge would be beneficial for operations. For this reason, one of the goals of Project Flywheel is to build a **learning organization** in which people can continuously learn from each other's experience, collaborate and generate new learnings by acting together.

The problem statement was validated with a round of interviews to Venture Partners (VPs). I reported a sample of three answers below.

VP1: *"We do not share enough learnings with Venture Developers (VDs) and VPs. We need to include VDs and Technology Assessment and Strategy (TAS) in learnings about ventures built. Especially, we need to share what we are not doing right, and people are reluctant to share this kind of information."*.

VP2: *"We are not yet sharing learnings effectively within the VPs. Learnings should be through databases but not alone. We need to make sure that people learn from practical experience, group sessions, anything. Knowledge in a database is useful because people know that it is there, but what we need most is to share the interpretation of the information. I don't know much about other VPs' ventures. Onboarding would also benefit from efficient learning sharing."*.

VP3: *"We are not sharing learnings enough, but something is changing. There will be knowledge session every two months about learnings from the ventures in portfolio, involving VPs exclusively. Including the VDs would be an obstacle to these sessions because with the group increasing its size it would be more difficult for the session to be effective. We need different ways to share learnings with VDs, Venture Finance (VF) and TAS."*.

With these answers collected, I decided that I wanted to help the company to structure a scalable model to store and transfer knowledge effectively in the organization. As a preliminary step, I mapped the **learnings opportunities** within the Venture Creation team (Fig. 10).

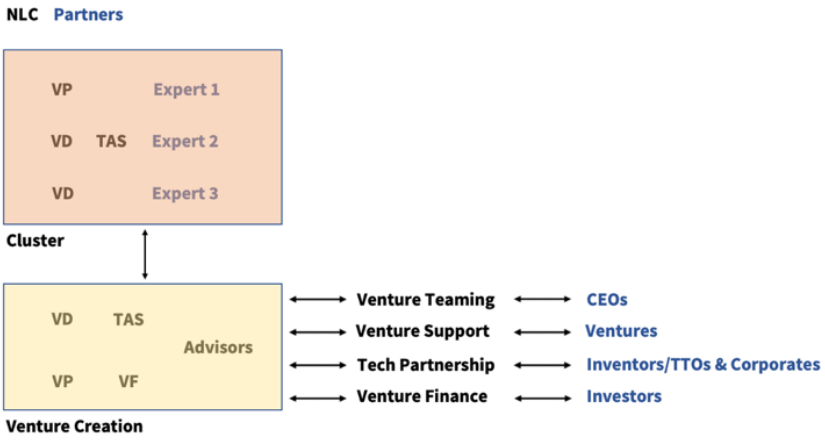

Fig. 10. In black the teams and team members of NLC; in blue the external partners of NLC. Arrows represent interactions and learning opportunities. The image highlights the learnings focusing on Venture Creation (some teams and interteam learning opportunities were omitted).

Knowledge accessibility

I approached the problem statement of this report by investigating the difficulty to retrieve information from NLC past experiences. I assessed the accessibility of information by answering an interrogative that I've been presented to during a meeting with a Venture Creation focus group. The question that needed to be answered was whether the inventor's involvement in the ventures that NLC builds is correlated to the venture success. In NLC databases, I could not find information about whether the inventor was involved in the venture, and if so, in what role. The people that I thought would possess this information were VPs and members of the Venture Support team. I found out that the most efficient way to answer the question was, however, to interview VPs because they have a closer relationship with the ventures in portfolio by helping their CEOs with strategic decisions.

The inquiry about the correlation between any variable, in this case being the inventor's involvement, and venture success is hard to answer in principle because it is notoriously complicated to define success in deep tech startups at early stage of product development. However, for the purpose previously defined (evaluate accessibility of information), I considered a broad definition of success as good enough to start with the investigation of NLC knowledge ease of access. Interviewing 10 VPs (**coverage of 87% of total ventures in portfolio**), I investigated if the inventors are involved in the ventures in their portfolios and whether VPs consider these ventures as successful. As a result, I found out that more than 80% of the inventors are involved in the ventures built by NLC, with exceptions being ventures originated from IPs licensed from corporates. The inventors are considered by most VPs essential in the product development and venture building process. Moreover, I collected some qualitative indicators of success of early

stages ventures according to VPs, and I believe that this kind of information are worth to spread at the team level to build more quality ventures (not reported in this report because not relevant to the main problem statement).

What I found interesting is that this knowledge is accessible because most VPs are involved in NLC since the very early stage and they collected all information to keep track of their progresses. However, this knowledge is confined within the VPs and it is not immediately accessible to the rest of the team.

This preliminary test allowed me to identify a crucial obstacle to effective team learning and organizational learning. In fact, meaningful ventures-related knowledge is present as tacit knowledge within the VPs. According to Wilson et al., 2007, the team failed to learn if, when a component leaves, the rest of the group cannot access his/her knowledge. Therefore, what is needed for successful learning is the interaction to integrate individually held (meaningful) information into the team's **collective knowledge state** (Wiese C. W. and Shawn Burke C, 2019).

This consideration motivated me to investigate more into the organizational processes that could be improved to enable NLC to fully leverage the knowledge generated from experience. I will look at the different learning opportunities in the organization with the aim to transform the tacit knowledge into explicit knowledge, developing more *knowledge keepers* even if they learned vicariously (e.g., a VP collects knowledge from the experience with a venture, then teaches the VD who learns vicariously; now the VD can transfer the knowledge to people who would benefit from having the information).

Benefits	Improvement points
VPs are open to share venture-related knowledge	Tacit knowledge confined within VPs

Team

According to the *team learning as a process* conceptualization, **intrateam learning** behaviors refer to how the team collects new information from fellow team members and how the information is integrated in the collective knowledge state (Wiese C.W. and Shawn Burke C., 2019). In this section I dissected how intrateam team learning at NLC occurs, considering the Venture Creation team and the clusters. Finally, I highlighted the features that are not allowing the team to leverage the knowledge available at the team level.

Venture Creation

The Venture Creation team, composed by Venture Developers (VDs), Venture Partners (VPs) and Technology Assessment and Strategy (TAS), collaborate to move forward in the pipeline solid business cases that are evaluated by team members, with the addition of a Venture Finance (VF) officer. The conversation that takes place during the evaluation of the **investment proposal**, result of the due diligence conducted by VDs, is a moment of learning for all the people involved. The TAS member gives feedbacks about technological feasibility and strategical considerations of the product that will be developed by the venture; the VP shares his/her experience contextualized in the relevant area in which the business case is presented; the VF officer gives feedback on the **financial projections** and discusses the revenue model which could maximize financial value generation. The VD finally integrates the inputs in the investment proposal and re-evaluates the case. The feedbacks influence the downstream decisions on the business case built by combining the **experience** of the leading VP, **evidence-based results** of the case and the *gut feeling* of people attending the conversation. These conversations aim to identify what are the risks associated to the business cases, not to avoid them, but to take decisions on well calculated risks.

Developing entrepreneurship at scale, NLC should minimize the bias introduced in the decision-making processes by integrating, already at the first investment proposal stage, historical data of the medtech ecosystem responses to risks taken in similar business cases. This would allow to *connect feedbacks from the ecosystem to each calculated risk taken*.

Some VDs have a license for **GlobalData** and **PitchBook**, very useful tools that help building data driven business cases by analyzing thoroughly the competition and the landscape of new technologies. However, these databases do not capture the development of the business ideas from the early stages. In order to do that, "an internal database of ventures built would be *a dream*" (Interview response, Data & Analytics team). The data that NLC generated with its 100+ ventures could be already of great help if integrated into the decision-making process, however the time of venture development requires patience before meaningful data are generated (e.g., financial rounds, market share obtained, etc., might take years before being produced). The solution that is currently being used is **ZoHo**, a highly customizable software that has been adapted to the pipeline of NLC. ZoHo contains the data of leads processed, but its resolution is not capturing a lot of information which could help to establish a general policy to manage medtech innovations.

Equally important data for the learning purposes are information about the leads that have been **rejected**. To be more concrete, I will do an example of a lead which has been rejected in Selection. I was working on the due diligence of a network neuromodulation prototype built by a very competitive international team. The technology was strong because the technological features were 8x better than competitors. However, what was missing was a clear therapeutic condition that could

build a solid business case. In fact, the device could have been employed in different psychiatric conditions, as it was early stage and could be adapted on a specific unmet need. Considering the unclear problem that the technology would have solved, along with the substantial investment needed (>30M EUR), the team decided not to pursue the project as considered very high risk. In these cases, where the Venture Creation team believed that there was potential and took this decision after long debates, NLC should be interested in developing a standard pipeline to capture data of the technology development even once the lead was rejected (if the inventing team agrees to update NLC). On the inventors and TTOs perspective there could be interest in doing so because it would represent still a semi-open door for them to get to work with NLC. This situation has been acknowledged and recently some initiatives started to capture data of promising leads that have been rejected because too early stage or for a problem-solution fit issue. In these cases, it would be possible to have feedback of the decision by measuring, for instance, the interest of other VCs and corporates in the technology.

In conclusion, from my interviews, I found out that what is missing at this stage is the **comparison with relevant business cases previously built**. This is exactly the knowledge that needs to be leveraged in order to build a record of NLC operations with the respective feedback from the ecosystem (e.g., partners interest, fundraising success, CEO findings). The purpose of tracking all previous experiences of the Venture Creation team is a way to capture, in the long run, patterns in the process of venture building so that future predictions can become increasingly accurate. This would also ensure to avoid repeating past mistakes and would increase the awareness of what attention points are/are not relevant for decision making. This attention point will be further discussed in the *Organization* section because it comes from the collaboration of different teams.

Benefits	Learning type	Improvement points
Interdisciplinary team learning while discussing investment proposals	Action learning but missing the reflection part, e.g., people need to discuss the predictions when the venture starts operating	Awareness of data generated
		Accessibility to data available

Cluster

Another collaborative unit relevant at the team level is the **cluster**, which is a specialized unit in the Venture Creation team, in which clinical experts are integrated in the venture creation team in order to evaluate unmet needs and new technologies. There are currently four clusters that are active in the medtech domain: **musculoskeletal** (**MSK**), **cardiovascular** (**CV**), **digital health** and **green health**. The learning

opportunities in these clusters are enormous. When I attended a meeting with a panel of experts from the MSK cluster, the conversation was extremely technical and both VDs and VPs received feedbacks enriched with tailored clinical knowledge specific to the problem that the technology presented was addressing. Experts were visibly engaged because in contact with the latest innovation, potentially marketed in the near future.

The cluster offers an opportunity for personal development and **specialization** in a specific area of the medtech domain. Additionally, it provides early feedback from the ecosystem which can be coded as a marker for later success of the ventures based on technologies discussed with the experts. However, the knowledge collected from these meetings is transferred orally to NLC participants and written in text files or emails that are not handy to navigate. For this reason, I identified the issue of **information accessibility**. An additional obstacle to team learning is the development of a specialization on top of tacit knowledge which would be lost when the individual owning the knowledge eventually abandons NLC. However, according to the results of my interviews, it is controversial whether NLC aims to develop a specialized knowledge in specific clusters. Some people believe that NLC should aim to develop a specialized knowledge, investing a significant amount of time to become a specialist in a specific area. Others support the perspective that the knowledge allowing the Venture Creation team to be able to build robust business cases is a **generalist** type of knowledge, which is recombined with the specialized expertise of experts from the company network. What I believe is that specialization is a non-binary dimension, and to some degree all the people working with technologies in a specific disease area develop a sort of specialized knowledge. The specialization achieved in these activities cannot be compared to the specialization degree reached with a PhD (not necessary to have for the evaluation of new technologies).

Important to mention, is that the Venture Creation team members actively engaged in the clusters can be viewed as vehicles bringing into NLC the expert-level knowledge provided by experts, into the Venture Creation team of the medtech domain.

Benefits	Learning type	Improvement points
Reaching some degrees of specialization to better direct investments	Action learning	Data capture and transfer
Early feedback from the ecosystem		

Experiments

The Venture Creation team is very entrepreneurial and design experiments to identify the model which allows the company to maximize value in the venture building process. What I noticed is that whereas the experiments on the venture building model

for each domain is well tracked, the progresses of experiments, such as investments in previously unexplored verticals, are not quantitatively monitored yet. **Experiments** on verticals and geographical areas have the potential of providing concrete learnings that would allow NLC to screen the ecosystem and understand what kind of innovation benefit the most its operations. To mention once more the chess example in the *Research Question* section, the reward/punishment of an experiment (e.g., building ventures in the VR vertical) is easily interpretable at the end of the process, when a venture successfully develops its product, or it gets discontinued for different reasons. However, the purpose of the experiment should be to **generate** as many data as possible to structure a **data-driven** decision-making by evaluating quantitatively the development of ventures that need to be "tested".

I believe that it would be appropriate to formulate some key metrics to test *before* the experiment starts, and then learn as the experiment progresses, what are intermediate markers for success/failure. I chose to describe an example of the digital healthcare cluster, in order to illustrate better what I mean. An experiment that the team agreed on conducting was to build some ventures starting from open-source codes. Open-source software is an example of *User Innovation Community* because they allows users to access a copy of the code for free, modify it and distribute it to others (Von Krogh G. and Von Hippel E., 2006). Revenues from ventures based on open-source are guaranteed in different ways, according to the business model developed. A popular example of open-source business models is the *Loss Leader*, in which the software, leader, is distributed free of license fee and the revenues are achieved with products, coming after the leader, sold with the traditional software business model (Charvat K. et al., 2014). Since this field of innovation is relatively new, and even newer in the healthcare space, it is necessary to understand what the best ways are to develop ventures in this domain. In the digital health cluster, it is important to keep in mind that the legislations influence hardly the venture building possibilities. At the moment, the **CE-marking** for open-source software is something ambiguous, and I believe that the cluster would benefit from leveraging the network to sense what the legal regulations would be. As an example, a recently published article mentions that the EU could potentially ban open-source operating system, which would mean that all the ventures built in this area would need to adapt and reorganize (MULLVAD VPN, February 1st, 2023).

Key attention points to test, in order to identify whether the experiment is worth to pursue, should be set in advance and measured along the way. For instance, in this case, NLC could measure the time that it takes to find an experienced CEO, time to market compared to different digital healthcare applications, willingness of customers to adopt the software, investors' interest, corporates discussions and competitors' moves.

Benefits	Learning type	Improvement points

Expansion of scope and development of new competencies	Adaptive learning	Data capture and usage

Organization

In this section I focused on **interteam learning feedback loops** which are relevant for the whole company.

Venture Finance-to-Venture Creation

When the Venture Developers (VDs) write the first investment proposal, to evaluate whether a lead will be moved to the Selection stage, they develop a financial projection which is called **Back of the Envelope** (**BoE**). Voices that need to be filled in this document are estimations of product development costs, regulatory costs (e.g., CE-marking), clinical trials expenditures, market size (patients affected by the conditions), expected market share that can be gained, expected returns, etc. These data are often not accurate because the (single) benchmark available is based on assumptions which are not generalizable to all clusters of medical devices and software. Additionally, especially for innovation in the digital healthcare cluster, it is hard to find data of similar products on databases such as Global Data and Pitch Book. One way to improve the accuracy of the investment projections is to establish a feedback loop from the VF team to the VDs. In fact, by comparing the expected investment needed to develop the product with the actual investment that was required in the ventures would be a moment of reflection on actions taken in first person by the VD who envisioned the investment projection. Also, making these data available would establish more **meaningful benchmarks** for similar innovations assessed in the future by any VD.

I report here a sample of two answers that I collected during my interviews to VDs:

VD1: "*The Back of the Envelope (BoE) benchmarks could be improved because the tool is not up to date. If it was updated with all ventures in portfolio, we could estimate clinical trials costs and length looking at real business cases built by NLC. We do not currently check the comparison between the BoE and the actual funds necessary. In this way we could learn from the ventures we built and not only from experts. We really need to do it. In the digital cluster we could also learn from the ventures' CEOs what business model they are using*.".

VD2: "*A more effective due diligence would be achieved if NLC possessed a lot of quantitative metrics. Understanding clinical trials and money needed for regulatory strategies would be extremely beneficial. We should understand how the ventures are proceeding, after three/four years that the venture was built. This would allow us to validate assumptions that we discuss during the investment proposals' conversations.*".

The learning opportunity here is to establish a feedback loop that is concretely transformed into a moment of **reflection on action taken**, and adjustment of future experiences. This is a fundamental part of the learning process, both in the reinforcement learning framework and in the action learning. An option for this feedback to occur is to have a conversation with the people involved in the venture development pre-building phase at 1- or 2-years distance since the venture was built, and discuss what was well predicted and what was not.

Benefits	Learning type	Improvement points
Interdisciplinary interaction	Anticipatory interteam learning, missing reflection	Feedback to Venture Creation
		Build internal benchmarks
		Data awareness and accessibility

Venture Support-to-Venture Creation

As previously mentioned, VPs and the Venture Support team work closely with the ventures built by NLC. While the VP support the venture with **strategic decisions**, the Venture Support team is the *spider in the net*, connecting the CEOs with the most appropriate partner for whatever need the venture has (e.g., regulatory strategy). The support provided by the Venture Support team consists of **CEO community management**, **kickstarter program** (composed of regulatory sprint, strategy sprint, story sprint and final sprint) and **venture services**.

My initial hypothesis was that the Venture Support team could favorite the integration of venture-related learnings in the Venture Creation team because they work the closest with the ventures. With the interviews conducted, it was clear that the technology and business knowledge generated from the ventures is instead accessible mainly to VPs. Considering the venture-related knowledge that is relevant for the VD decision making processes, I would highlight (I) the **comparison** of projected business model and actual business model and (II) the **integration** of ventures strategies to address the riskiest assumptions identified when building the business case. As previously mentioned, this knowledge is present as tacit knowledge within the VPs and it could be useful to other VPs, as well as VDs and TAS.

In the next part of this section, I will focus exclusively on how learning is achieved by the Venture Support team and what could be improvement points for the organization, with a special focus on the Venture Creation team.

The Venture Support team learned by experience that the main concern for CEOs is generally the **regulatory strategy**, for this reason it became the first point addressed in the kickstarter program, when the venture is being set up. In the previous section, *Venture Finance-to-Venture Creation*, I reported the answers collected by interviewing VDs about the interest in regulatory operations from NLC ventures. In fact, VDs not only need to know how much money are spent in the regulatory and clinical trial steps, but they would also benefit from receiving trainings on what kind of regulatory pathway to expect for specific subsets of innovations. In this context, the feedback of what regulatory strategy was possible, and why, for specific ventures, is an opportunity for professional development which would increase VDs' awareness in building strong business cases, finally improving the quality of activities of the Venture Creation team.

During the **kickstarter program** of a cohort of ventures built, I took part to the clinical regulatory workshop held by the Venture Support team to the CEOs. The session was structured as follows: in one hour the CEOs are presented to the guidelines active in the USA and EU for marketing a medical device/software; after that, each CEO has a 1:1 session with the regulatory specialist from the Venture Support team, which will connect the CEO with the partner company that can better satisfy the partner needs. What I found interesting was that the Venture Support team possessed some information that would benefit the Venture Creation team, but people are not aware of that. For example, the time that takes before the request for CE marking/FDA approval is even consider is ~2 years. This time gap before the relevant EU notified body considers the application for CE marking of a new medical device is an important information when considering the innovation pathway (e.g., entering US market first could be more beneficial). Additionally, at the Selection Investment Proposal (SIP) stage it is required to estimate the time to market of the new technology and without this information there could be inaccuracies introduces that could compromise the development of the venture.
In case of a software that only needs a regulatory mark and does not necessarily need clinical trials validation, a VD could estimate a one year to market with CE mark. Considering the delay of the notified bodies in the EU, this is clearly not possible. In case the venture is built, the CEO will find out that NLC projections were too optimistic, in the previous example, and will adapt consequently. This will not represent a big problem for the venture, because the fundraising starts when the CEO is on board and decides on a business model and regulatory strategy. However, this indicates that is likely to introduce errors in this time estimations, in addition to the financial projections, because different variables need to be taken into account. Considering that the venture can be built regardless any time/money risks if the VP considers it promising, the logical conclusion is that at the SIP stage is very likely that time, and money, estimations are not accurate.

Benefits	Learning type	Improvement points
CEO-centric services	Adaptive learning	Feedback to Venture Creation

Venture Teaming, Tech Partnerships, Legal and Expertise Integration-to-Venture Creation

Once the venture is in Formation, the **Venture Teaming** team starts the CEO search and interview process. The Venture Teaming team is well organized and adopts digital tools, such as **GreenHouse**, to review candidates and keep a CEO pool from which to select the right person for the venture that better match his/her experience. By informally talking with a member of the Venture Teaming team, I found an opportunity for both the Venture Creation and the Venture Teaming teams, to collaborate and learn from each other. What is likely to happen now is that the CEO recruiter interviews a CEO candidate for a venture for which he/she does not have the desired background. However, the candidate has a great experience and has the potential to be a great CEO for one of the ventures that NLC will build. In these cases, the recruiter could benefit from having information beforehand of the kind of ventures that the Venture Creation team has in the pipeline, so that from the first contact, he/she can mention to the candidate that he/she would be a great fit for a venture that could possibly be built in the near future. This process is currently working smoothly because information of leads in Selection, likely to get to Formation, are made accessible to the Venture Teaming team by the Venture Creation team.

In the case of the **Tech Partnership** team, the account management efforts need to be coordinated with members of the Venture Creation team who outreach to contacts that are related to key accounts. Recently, the Tech Partnership team adopted the CRM **Affinity** to improve account management coordination and data capturing. The system will address all the issues of coordination and alignment by tracking contacts in time and people involved, improving the overall NLC performance.

The **Expertise Integration** team is conducting internal research to identify improvement points to establish guidelines that aim to improve the expert outreach process by tackling two main issues: **awareness** and **coordination**. Also, the team started the *open clinic* initiative with the aim to provide an internal and early feedback on the clinical relevance of leads in the Scouting phase. Additionally, the scope of the open clinic broadened by allowing anyone interested in a clinical topic to ask questions and develop knowledge which is relevant to NLC activities. The meeting occurs on a weekly basis for an hour.

In case of the **Legal** team, the Venture Creation team needs to make them aware of new technologies (e.g., open-source) and new countries of incorporation to allow them to work on policies that need to be established.

Benefits	Learning type	Improvement points
Collaboration	Adaptive learning	Alignment and coordination (progressively being solved)

Data capture
Personal development opportunity

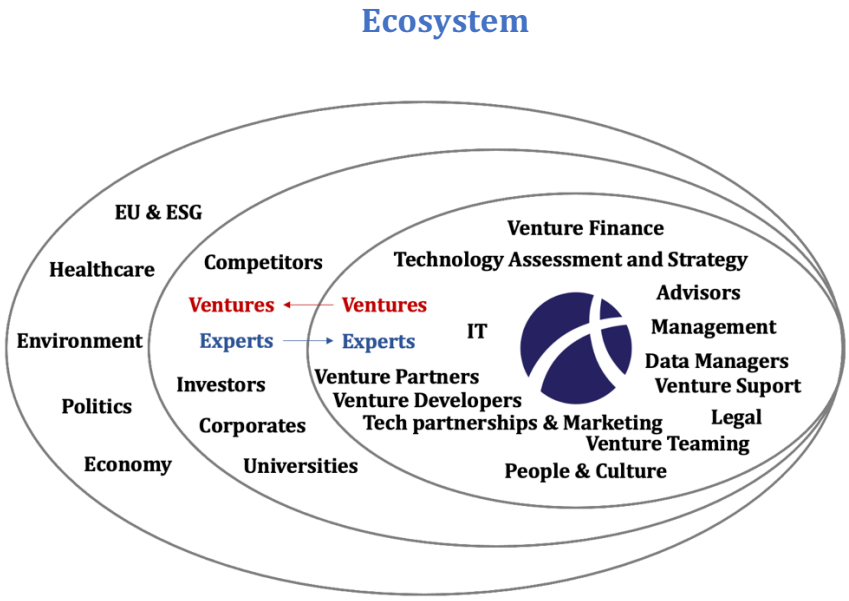

Fig. 11. NLC ecosystem.

In terms of the broad **medtech ecosystem** in which NLC operates, the key stakeholders are universities and TTOs, investors, ventures, experts and corporates.

In Fig. 11, I represented in red the ventures as emerging in the NLC inner company environment, and then progressively going towards the second circle. The reason for this is that with the progression of the venture, the more external investments are raised, the less NLC controls the ventures. This happens by definition, as NLC shares of the ventures built dilute in time, finally achieving an exit. There is a case of a venture, who is now owned by various shareholders to the point that it stopped reporting to NLC (not even the quarterly report).

Lots of learning opportunities are also possible by interacting with **investors** and **corporates**. For example, recently, NLC built a venture, which has received a substantial interest from investors and corporates which are willing to finance it even before the technology produced a proof-of-concept. This is clearly extraordinarily positive feedback from the ecosystem that needs to be further analyzed, generalized and transmitted to the Venture Creation team. What has been hypothesized to be the reason generating this great interest is the market size, people on board and the specific area which is expected to be a trend in the cardiovascular space. Interestingly, this venture is the first one to test the experiment of having a **Venture Manager** before the CEO is hired. The Venture Manager is a VD that participated to the venture building process and operates to set up

the venture in the *healthiest* way possible. An important note here is that, in case the Venture Manager experiment brings nice results, by being the person experiencing the ecosystem responses, he/she can be the key person to bring into NLC these important learnings (lowering the workload of VPs who don't have enough time to do that).

Regarding the learning opportunities in **relationships management**, the Tech Partnership team, historically responsible for corporate relationship development, is also learning from the experience of establishing relationships with corporates and TTOs. The advantage of having solid, long-term relationships with universities is that the inflow of technologies can improve in quality. In fact, more technologies could be sourced and the dealmaking is likely to be smoother as a consequence of good account management practices. The adoption of Affinity is helping the company to map the relationship established and manage them with a superior consciousness, improving the awareness and coordination of the company.

Expertise integration is also working on establishing long-term relationships with clinical experts, who can be involved in the due diligence of new technologies. As most people in the Venture Creation team agrees that one of the most time-consuming step in the due diligence process is the **expert outreach**, the relatively newly established expertise integration team is working to integrate an increasing number of experts in NLC ecosystem. As highlighted from one of my interviews, "*the best strategy for VDs to outreach to experts is the one that minimizes the cost and maximizes the quality of work and minimizes the waste, in terms of money and time*". On this account, I initially thought that it was naïve to expect experts to give NLC feedbacks without paying any, or just a small, fee. However, it was reassuring to find out that clinical experts are mainly interested in non-financial incentives. From my interviews I noted that the most appealing incentives for experts are impact, networking, gaining advantage over colleagues, opportunity to get involved in clinical board and the recognition of being an innovator within the field.
Surprisingly, I found out that another feedback could benefit NLC operations, even at the ecosystem level: the **feedback to experts** that actively participate in the clusters and in the due diligence of NLC technologies. As emerged from my interviews: "*we need to have a pool of experts who we frequently reach out to, and we need to provide them with feedbacks on the decision made during our discussion. Only then, also the experts will learn*". I would add that the learning experience is probably an incentive which motivates the experts to join the NLC community. As initiatives are activated in this direction, NLC is experiencing a transition of the experts' degree in involvement from the second circle in Fig. 11, to the inner NLC community.

Benefits	Learning type	Improvement points
Coordination (Affinity)	Adaptive learning and action learning	Feedbacks to Experts and Venture Creation

Convergence: Team, Organization and Ecosystem

To converge towards a solution, I believe that it is useful to investigate team **learning dynamics** over time. A theoretical model is presented here as framework that applies for team, organization and ecosystem.

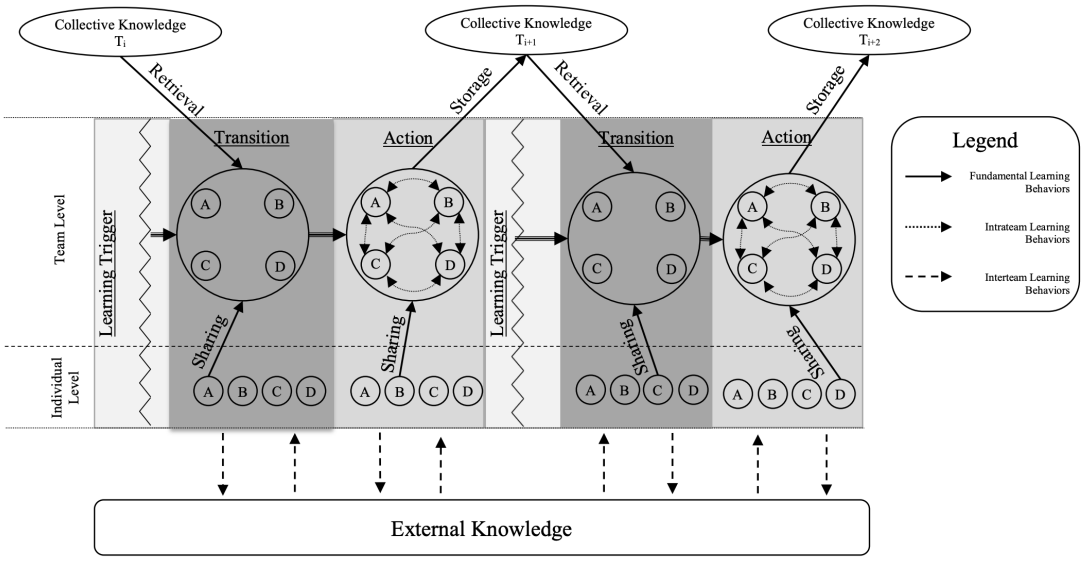

Fig. 12. Unfolding model of team learning (Wiese C. W. and Burke C. S., 2019).

In Fig. 12, it is shown how the model unfolds. The **learning triggers**, events that induce the team to *scan* the collective knowledge, are likely to arise from both individual sources and team sources. A learning trigger is, for example, a moment of **reflection**. According to Wiese C. W. and Burke C. S., learning triggers generate team learning episodes. Learning episodes are composed of a **transition phase** and an **action phase**. In the transition phase, the learning trigger cause *collective awareness* of team members. This phase has been described as crucial in order to achieve effective team learning. After collective awareness, the action phase begins by *integrating new knowledge* in the collective knowledge state. Enrichment in the collective knowledge state is generated via discussion, experimentation and conflict. The knowledge also needs to be store consciously so that it allows easy retrieval.

The brilliant work of Chris Argyris highlights that "*the very success of professionals at education helps explain the problem they have with learning*". The problem that the author identifies in well educated professionals is that they are performant at **single loop learning**, but they often fail at **double loop** learning. Single loop learning refers to the

ability to make changes to correct a mistake, whereas double loop learning aims to understand what caused the mistake to happen (Argyris C, 1991).

The practical challenge is how to effectively integrate learnings in the collective knowledge state. Learning is often believed to be a consequence of motivation, but it is rather a consequence of people's mental model (cognitive rules for how people design and implement actions). The aim of the solution that I present in this report is to provide a tool that can help the company to share and integrate learnings, as well as developing a reflective approach that would enable **cross-pollination** of knowledge. The result that can be reached with the tool proposed is to modify each employee mental model with the purpose of engaging double loop learning loops more effectively.

Towards the solution

Situation	**NLC can further leverage the knowledge obtained from past experiences**
Complication	**The knowledge present in the organization does not achieve collective awareness**
Key Question	**How to build an organization able to define meaningful targets (e.g., more ventures)?**

Fig. 13. Situation, complication and key question results.

Using the Accenture's problem-solving framework (see *Methods* and Fig. 13), I developed a concrete solution to help NLC building a learning organization able to define meaningful targets and build more quality ventures per time period.

To develop a solution that can concretely help NLC, I mapped the improvements points discussed in this section, with the aim to address them all.

Improvement points	How to improve
Tacit knowledge	Transform it into explicit knowledge
Awareness of data generated	Map and communicate findings
Accessibility to data available	Files need to be easy to find and navigate
Post-action reflection	Set reflection meetings with people who collectively acted
Data capturing	Set beforehand what needs to be recorded and for what purpose
Data usage	Smooth processes to capitalize on data generated

Feedbacks establishment	Report relevant information to people who would benefit from it
Internal benchmarks establishment	Organize data and make them actionable
Alignment and coordination	Communicate who is doing what and how

PuzzLearn

The new organizational **Wiki**, developed by the IT team, will be integrated with **Slab**, a program that is able to link the user, typing his/her needs, to the direct source of information, which could be a Slack message or a document in the Google Drive environment. The tool has also a semantic search feature which avoids the user to type the exact key work to access a specific information. The tool that I proposed to NLC is a **gamified solution** compatible with Wiki. The reason for my solution to be gamified is because it was shown to improve engagement (Looyestyn et al., 2017), which is a necessary feature for a knowledge management platform of a learning organization. The addition that my project would bring to the Wiki is a system of incentives (see *Conclusions*) to share learnings and increase the volume of meaningful data available in Wiki.

Here I describe the way I envision the knowledge to be gained, distributed and accessed. I started describing the rules of the game to finally transition to the user workflow.

The fundamental gamified unit of the software is a **puzzle**. The puzzle represents a collection of knowledge. Each puzzle piece is an information, relevant to the puzzle topic, which can be given and/or received. There are three types of puzzle pieces: **teacher pieces**, **student pieces** and **exchange pieces**. The teacher pieces represent the transmission of knowledge, the student pieces are the acquisition of knowledge, and the exchange pieces indicate that some knowledge is given, and some received. In order to attach two (or more) puzzle pieces, knowledge needs to be transferred. For this to occur, an **interaction** is required. Teacher and student, as well as exchangers, can interact according to their preference: discussing a topic in a Zoom call or via Slack messages. By interacting, the pieces are connected, and the puzzle progresses to completion. The puzzle is completed once the knowledge achieves the transition to the team/organization collective.

The game offers many different puzzles. Each puzzle expects certain people to complete them. For instance, there are puzzle exclusively for the Venture Creation team (e.g., term-sheet discussions), some for the Venture Support team (e.g., CEO network), some for members of both teams (e.g., regulatory landscape), some for the whole

organization (e.g., shared values), and so on. In each puzzle there are puzzle pieces representing the information that are relevant for the puzzle's topic.

To start, the user is required to upload the most recent CV, agree on automatic synchronization of Google applications (e.g., calendar) and agree on anonymized storage of data. This will ensure that the software automatically maps what knowledge comes with the user (from previous experiences and previous meetings synchronized from Google calendar). The user can manually adjust the knowledge in his/her possession and proceed to the home page. The interface shows a map with completed/uncompleted puzzles that can be accessed by the individual users, according to their **profile**, **personal development goal** and **belonging team**. The user can open a puzzle requiring his/her input as teacher/student and advance the puzzle by accessing the calendar of the person who he/she wants to interact with, to teach/learn/both. The meeting, or exchange of messages, need to be scheduled in the calendar event that will have the name of the puzzle pieces (information) to attach. The user, by opening a puzzle window, becomes aware of *who knows what* with respect to a specific topic.

Once the event in the calendar is created, there are two possible scenarios, according to what method was selected as **interaction modality**. In case the users selected an exchange of Slack messages to share knowledge, the Wiki will be able to link the user, searching on Wiki the information discussed, to the message exchange directly to Slack; otherwise, if the interaction happened via Zoom, the meeting is automatically transcribed, omitting personal or confidential conversations in between, and stored as text file in the Wiki database. In the long term, the data collected with PuzzLearn will improve the completion and accuracy of the organization's Wiki. This will allow the Wiki to become a *ChatGPT-like* tool that generates answers to topics by providing constantly updated information that are made up of pieces of knowledge that are collected during the puzzle interactions. For example, in case someone searches on Wiki "what is an open-source software?", the Wiki would display a document with links to Drive documents, summaries of information collected and contacts. PuzzLearn and Wiki will coexist and coevolve. Eventually, the system will be scaled to the whole ecosystem by creating puzzles that can be completed by interacting with experts, universities, corporates, etc. By integrating the tool with the new CRM Affinity, the experience will be automatically updated and would require very few inputs from the users.

This tool is inspired by the Andersen framework, (Fig. 14), in which team members are engaged in **collaborative learning**, taking in turn the role of teacher (**coach**) and student (**learner**).

At scale, the tool would solve the issue of having busy high-ranked people (e.g., VPs and managers) as only source of knowledge. Let's take as an example the knowledge generated from operations of ventures in portfolio. The VP possessing the tacit knowledge related to a subset of ventures, transforms the learnings into explicit

knowledge by transferring it to a VD, who becomes now a knowledge source that can share this knowledge to other people in the team/organization. As a domino, I envision this kind of information to be shared with all people that would benefit from a specific information. In this example, the knowledge acquisition modality would clearly be different as the VP learned by experience, and the VD vicariously learned by interacting with him/her. However, for the purpose of creating collective awareness I believe that this transfer method is sufficiently good.

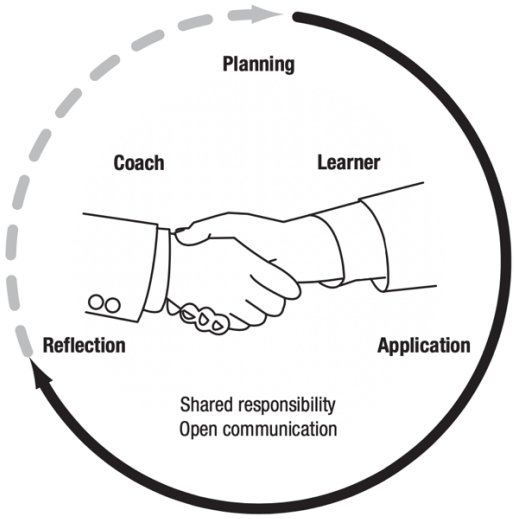

Fig. 14. Andersen's framework (Marquardt M.J., 2002).

To illustrate an additional example, let's assume that a new Venture Developer (VD) joins the Venture Creation team. In that case, puzzles that are relevant to him/her will be diluted. Dilution means that more student pieces will be added to the puzzle and, in case the puzzle was completed before he/she joined, the puzzle at that point would need to be completed again by providing the new joiner with the information that previously reached the collective awareness state. As he/she progresses the onboarding and interacts with people, the puzzle continues to progress. It's the interest of all people involved to keep a puzzle complete.

This tool will create a lot of learning opportunities, some unexpected, as the access to new knowledge will generate desire and opportunity for everyone to understand the ecosystem in which NLC operates. The Wiki will benefit from diverse point of view on the same topic that people learned via different modalities. In fact, different experiences might generate different learnings (or validate the same learnings), available to all the Wiki users (Fig. 15).

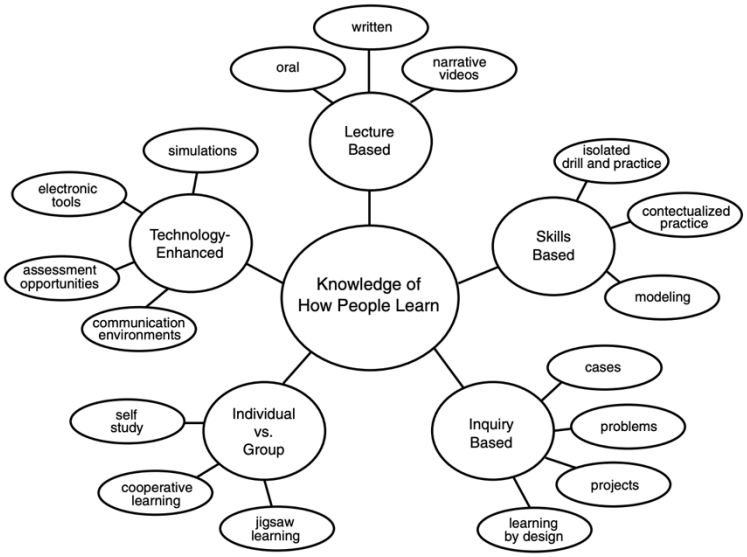

Fig. 15. Learning modalities (Bransford J. D. et al., 2004).

In the *Conclusion* section I evaluated the benefits that the tool will bring to NLC. I also addressed possible issues associated with the tool, providing a strategic approach to prevent them. I also discussed the relevance of building a digital community in which information are accessible to everyone and the quality of knowledge is peer-reviewed by providing rating to interactions' transcripts.

Conclusions

Following the design thinking framework (see *Methods*), I **empathized** with NLC employees and **defined** what the improvement points for organizational learning are (see *Results*). I **ideated** the PuzzLearn solution as it would be beneficial for almost all the improvement points identified. I'll illustrate the possibilities that the PuzzLearn knowledge management system offers by addressing its positive, neutral and negative aspects. Finally, I will discuss the state of **prototype** development.

Implications for the company

Positive and Neutral

Tacit knowledge would be transformed into **explicit knowledge** as a consequence of people instructing each other on topics that are relevant for the organization (e.g., venture related, financial related) or for personal development (e.g., desire to participate to an important external call). The tool will create **awareness of data generated** by providing a *map* of the knowledge available in the organization (each topic is associated to people). The map connecting the knowledge to people also addresses the issue of **accessibility to data available** because whoever processed some data to extrapolate learnings can teach people who can benefit the information to access them and **use** them. The tool would also improve the **post-action reflection** of people who made a decision together (e.g., when the venture is built and starts with fundraising, clinical trials and selling, the people who made predictions, and made decision on top of these predictions, meet and discuss). However, the tool would not significantly improve the issue of **data capturing**. In fact, even though the tool could suggest what data need to be captured and/or retrieved to **build internal benchmarks** (which are also not directly addressed by this tool), it would be only possible to capture data by monitoring the development of projects and retrieving data related to past operations. Most importantly, PuzzLearn would improve the establishment of **interteam feedbacks**. Finally, it would not affect the current modality of **alignment and coordination** (as it is already improving with the integration of the CRMs ZoHo and Affinity).

Negative

An aspect that could represent an issue associated with the incentives of interactions provided by the tool, is that people want to limit the **time spent in meetings**. To further understand the most appropriate modality of interaction I would need additional interviews to understand what people like and don't like about meetings, to design incentives within the game narrative around them.

Improvement points	
Tacit knowledge	✓
Awareness of data generated	✓
Accessibility to data available	✓
Post-action reflection	✓
Data capturing	
Data usage	✓
Feedbacks establishment	✓
Internal benchmarks establishment	
Alignment and coordination	

PuzzLearn will allow the learning culture to **self-sustain** and **grow**, exactly like the flywheel effect. The principle of PuzzLearn is that *the demand of knowledge creates knowledge itself*. The meetings are automatically transcribed and stored in the Wiki. By transferring knowledge with a human (virtual) interaction, the knowledge is also generated in the Wiki databases, allowing people to use the knowledge on-demand. The knowledge stored is **evaluated** by the community of users, employees, which improve the output of the Wiki by allowing the algorithm to prioritize information with a high rate. To address the negative aspect previously mentioned (people spending too much time in meetings), the tool could have a function to allow puzzle pieces attachment, representing the progression towards goal, also with a Wiki search. However, this should be only possible when the information that Wiki provided on a specific topic are good enough. In fact, if users rate the information stored in Wiki as not good enough or outdated, it will be only possible to attach two puzzle pieces by interacting with a human (virtual) interaction, in order for the Wiki to be updated. In this case, there would be interest to interact only when necessary, and it would limit additional time required in meetings. This possibility would introduce an additional dimension to the puzzle: the **transparency** of the puzzle pieces. The puzzle pieces are more transparent if the information exchange was rated poorly by the community, whereas it would be more colored if the community rates the information generated as good.

People with whom I discussed the tool positively reacted to the solution I ideated. However, the most critical question that I have been asked remains "*why would people be willing to use this knowledge management system?*". The answer to this question is that people **recognizing** that NLC could better leverage the knowledge available in the organization, would be happy to adopt a tool that favors knowledge sharing. I believe that the only way to achieve active engagement of employees on PuzzLearn is to make people aware of their development so that they can consciously perceive the benefits that the

tool brings. The reward system and performance graph design will therefore play a key role in the process (see *Gamification in knowledge management*).

Effective knowledge sharing and storage will become the real competitive advantage of NLC, which will understand by running operations what are the information more relevant to build a business case and identify markers of ventures' success.

In the next paragraph, I discuss the current state of gamification in the knowledge management space, highlighting what needs to be achieved for a successful development of PuzzLearn.

Gamification in knowledge management

Many organizations face the reality that their knowledge management systems are ignored by their employees (Durinik M., 2015). Gamification, defined by Deterding et al. as *use of game design elements in non-game contexts*, includes the introduction of points, badges, challenges, awards and rankings. These elements need to be designed coherently with the company culture and taking into account what motivates people. Fig. 16 shows the **self-determination theory**, which is useful to consider incentives that ultimately will increase the engagement of the users of the knowledge management system.

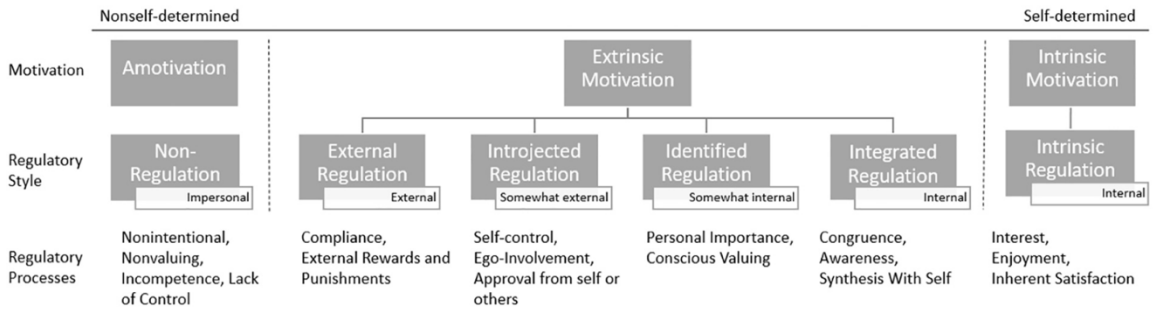

Fig. 16. Motivation is the intent to perform an action (Ryan and Deci, 2000).

More effective motivation is reached when people are intrinsically motivated, meaning that their actions are the means to achieve something valuable and interesting for themselves. This is what I aim to achieve with PuzzLearn: people should not feel the pressure or obligation to complete the puzzles, but they should do it because helpful for themselves and for the organization.

As a result of literature review, motivations driving knowledge sharing are *altruism*, *contribution to the company success*, *self-efficacy*, *reciprocity*, *fellowship*, *reputation*, *signaling competences*, *recognition* and *conformity* (Friedrich J. et al., 2020).

The author also identifies that game mechanics needed are **challenge**, **competition**, **feedback**, **performance graphs**, **rewards** and **status**.

Considering PuzzLearn, the major aspect that needs to be incentivized to start the flywheel is the demand and supply of knowledge. As a **challenge** element, the representation of achievable puzzles and collectable elements (*badges*) is an incentive that addresses the ambition of the user. The **competitive** element would be a scoring system based on peer ratings of information shared (e.g., 1-to-5-star rating, in a *Uber-like* fashion). Sporadically, there could be quiz events in which NLC employees compete on topics of organizational relevance. A relevant point raised by Friedrich J. et al. is that excessive competition could generate pressure on users, which is counterproductive for knowledge management purposes. The peer-community rating system aims to provide **feedbacks** that are opportunities for mutual recognition. The **performance graph** that can be included in PuzzLearn should aim to generate awareness of the effort dedicated, representable as contribution to the achievement of different subset of puzzles. The **rewards** that the puzzle game recognizes to users that contribute to the organizational knowledge management effort should be designed as social markers. Research showed that when all achievable rewards are visible, they become appealing for the users which want to be recognized by the community by having a higher knowledge management **status**. The functions of these elements can overlap, for example, a reward badge is desired and limited, making people compete to conquer it.

I also believe that in order to make the tool more engaging there need to be recurrent fun elements. An example is that the figure represented in a puzzle is a face whose features (eyes/mouth/nose/ears) are combined from the people who contributed the most to the puzzle progression and/or completion. A wide spectrum of narratives can be developed around the fun elements and incentive systems to make the tool more engaging for users.

Consulting literature, the main barriers identified to implement a gamified knowledge management system happen to be individuals, infrastructure and deontological (Sampaio M. C. et al., 2019). **Individuals** might lose interest in the reward system provided by the game narrative, causing lower involvement. In fact, the reward scheme implemented in the **infrastructure** needs to be well designed to highlight why the tool is meaningful for the users. Finally, the **privacy** of the users' data needs to be valued and respected at all costs.

Final remark

The **prototype** is still under development and many changes can still be applied. I believe that in order to develop an engaging and effective knowledge management system, I would need more time to co-develop it with the users: the employees. I would follow the **lean startup framework** in which data are generated by iterating customers'

usage on a MVP, which is progressively improved according to the user experience and feedbacks. This was not possible to achieve in the 6 months internship, but it is something that I am willing to continue doing with NLC.

In conclusion, I believe that NLC would benefit from the adoption of PuzzLearn because it would improve its ability to become **sensitive** to the ecosystem response. Early sensing capabilities are developed by integrating the feedbacks to actions taken in the venture building process. The integration of feedbacks helps decoding the NLC-ecosystem interaction and allows to adapt and steer. Everyone in the company should not lose the big picture as the organization scales so that all departments are aware of what is needed to reach a meaningful target. This would be ensured by sharing knowledge gained from experience to people who can echo relevant information to the right teams and people.

NLC also needs to continuously develop, update and review policies to maximize the value generated. This goal can be achieved by improving the organization's Wiki by creating a robust digital database of information that can be easily navigated. The tool has the potential to become a platform in which the community can share learnings and monitor knowledge flows in the organization.

Self-reflection

During my 6 months internship at NLC, I had the opportunity to achieve most of the **learning goals** that I set in the first two weeks in which I joined the company. The Fundamentals of Business and Economics courses at Utrecht University helped me to structure a problem-solving approach in the business context. With this thesis I considered the interest of the parties involved: **myself**, **NLC** and **Utrecht University**. While I was interested in working on a problem statement that I could get passionate about, with a focus on strategy, I also wanted to make sure that the results could be meaningful and concrete for NLC. Also, I needed to address all the evaluation points in the university rubrics, making sure that the development of the report addressed the key points required by the Graduate School of Life Sciences.

Here I reported a reflection on the **main interests**, **areas to explore** and **goals** that I communicated to NLC in the first two weeks of onboarding.

Main interests

I communicated to my company supervisor that I was mainly interested in learning **NLC strategy** in the context of scaling, standardizing processes, becoming data-driven and managing stakeholders' interests. Thanks to this research thesis, I investigated all these areas by conducting interviews and socializing with employees. I progressively understood and appreciated the importance of knowledge management, which I am now passionate about.

I was also interested in **NLC's ventures' strategy**, in particular in terms of resources allocation and partnerships. However, despite I had interactions with some of the ventures' CEOs, I figured that in order to have more time and intimacy to discuss their approach, I would have needed to spend some time in building a trusted bond. Considering the duration of my internship and the aim of my thesis I decided to renounce to do that and focus entirely on NLC strategy.

Finally, I was interested in learning about **new technologies** in the medtech and digital healthcare domain, learning about impactful innovation that could be developed in a venture. This was the central part of my role, and I am satisfied of the improvement of my technology assessment skills. Supporting the members of the Venture Creation team, I learned quickly what are the attention points to keep in mind when assessing a technology (e.g., problem-solution fit, market size). I could, in every case, integrate the due diligence with some desktop research and knowledge acquired in previous experiences.

Areas to explore

I was particularly interested to explore how **corporate partnerships** are developed, focusing on strategic alliances and joint ventures formation. I could investigate this area by interacting with people from the Tech Partnership team and by working on the due diligence of a lead that will be developed together with a venture studio based in Amsterdam.

I was interested in understanding how **KPIs** are developed for NLC's ventures therefore I supported the team that was developing impact KPIs. I interviewed a CEO to collect her venture's impact metrics, which were finally reported in NLC Impact Report 2022. I would have also liked to work on KPIs aiming to monitor venture progresses, but this process is still under definition.

I wanted to work on **innovations** from all different domains, but I ended up supporting the digital and medtech domain only. I would have liked to participate on some biotech project, but the team only allowed me to assess some patents that were offered as licensing opportunity.

Moreover, I wanted to attend in first-person a **negotiation** over deal-terms of IPs. I attended a call in which the term-sheet was discussed with a UK Technology Transfer Office (TTO). I was happy to be introduced to the language of the dealmaking process.

Finally, I wanted to acquire some **financial knowledge** in topics relevant to startup ecosystems. I benefitted mainly from my interviews and a teach-in session about investment rounds, equity, valuations and fund management.

Goals

I wanted to contribute to the **improvement of internal processes**, and I believe that with this thesis I addressed the main improvement points discovered with my interviews. I also wanted to produce a thesis that would have been useful for NLC, and I believe that I described situation that are helpful for all employees to reflect on.

Moreover, I wanted to gain the team trust to carry out tasks that require more **responsibility** than the standard "intern-duties". I believe that I achieved this goal because I had the opportunity to participate by myself to a digital healthcare conference in Amsterdam, representing NLC. During the conference I was happy to connect with people that are in the digital healthcare domain.

I also wanted to actively contribute to move at least one lead from **Scouting to Building**. This was an unrealistic goal considering that my internship lasted 6 months, and it takes on average 9 months to move a lead from Scouting to Building. However, I

am still satisfied with my work on leads that moved forward in the pipeline because I wrote 4 Selection Investment Proposals (SIPs) on technologies that finally were moved from Scouting to Selection.

Overall, I am satisfied with my learning experience at NLC. Interacting with employees I could access knowledge that I was not even aware that was in the company. This motivated me to work on this knowledge management project, to make sure that everyone, interns included, could easily map who own information in order to decide what to learn and become aware of the benefit of possessing crucial information.

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