ECOSYSTEM APPROACH TO LIFE-LONG LEARNING

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Abstract
The world is constantly changing and facing us with challenges to which we do not know the solutions. COVID-19 forms a clear example of this development. To be able to react properly on this type of development Life-long learning forms a crucial element in this. In this discussion paper, four inherently related concepts were brought together: life-long learning, cooperative learning, the Adaptive Cycle of Resilience (ACoR) model and ecosystems. By combining these concepts, we intend to rethink our learning structures. In this light, two questions are raised. One, how do we make sure we are prepared for unforeseen events like COVID-19? And two, what is the role of evaluation in the process of preparing for the unknown? How do we know what to evaluate? The main concepts are structured into a proposed integrated ecosystem architecture to facilitate life-long learning, which contributes to laying the foundation of the development of ecosystems in which life-long learning is the main objective.

Keywords: Disruptive change, Covid-19, disruptive change, ecosystems, role of education, learning structures

1 Introduction
The Covid-19 pandemic has compelled us to think about our current ways of working. From an educational perspective, two major problems stand out. One, how do we make sure we are prepared for such unforeseen events? And two, what is the role of evaluation in the process of preparing for the unknown? How do we know what to evaluate? In this discussion paper, the concept of life-long learning is discussed and integrated with cooperative learning and evaluation strategies. These concepts are united with the concept of ecosystems, which might prove to be an advantageous mechanism to support the facilitation of life-long learning. This way, this paper contributes to laying the groundwork for further research into the possibilities of utilizing ecosystems as a construct to facilitate life-long learning.

In 1998, Julie Davis brought to our attention that the end of the twentieth century is a period where we experience more and more uncertainty, instability and rapid change. This has proven to be especially true for the society and the environment. Davis (1998) therefore argued that we need “to equip children with attitudes, values, knowledge and skills necessary to rethink and change current patterns of action”. In that sense, traditional education has been the subject of change for many years. In his famous video ‘Changing education paradigms’, Sir Ken Robinson (2008) describes that every country on earth is reforming education in order for it to prepare children for the economies of the 21st century, while not being able to anticipate what the economies of the 21st century will look like.

Traditional education, and especially higher education, is often research based. It is designed for the short term; learning for now, and learning for the near future (Abcouwer et al., 2021-1). Traditional higher education regularly equips students with skills that are needed now, and in the near future (Takács et al., 2019-2). It is still largely concentrated around the transfer of existing knowledge (Sia, 2015), based on research. Research-based education results in educational programs with much profound knowledge, but also many knowledge gaps (Abcouwer et al., 2021-1) (figure 1).
Even if a student were to learn everything there is to know within a discipline, after graduation, because of the turbulent times we live in, it would further develop and change. This demonstrates the relevance of life-long learning. The traditional definition of life-long learning according to the European Commission is “all learning activity undertaken throughout life, with the aim of improving knowledge, skills and competences within a personal, civic, social and/or employment-related perspective” (European Commission [EC], 2001, p. 9). Traditional education has a declining interest in providing standardized educational programs, and an increasing interest in supporting society in its need to facilitate life-long learning. This trend has been visible for some time, but has insufficiently been recognized. The increasing social dynamics make it clear that there is a growing need for life-long learning in society. One of the consequences of facilitating life-long learning, is that there is an increasing need for an educational institution to be able to respond flexibly to current developments.

Takács et al. (2018) argue that “education in current practice is mainly organized in terms of learning objectives and end-terms of the curricula and measurability of the effectiveness of our education”. The standardization partly originates from the fact that curricula are accredited: “There is a need to meet certain standards and reach certain end-terms solely to obtain accreditation for the educational program” (Schilstra et al., 2019). It is therefore not surprising that many authors stress the importance of constant educational development, despite the standards. Gibbs (2013) reflects on the changing nature of educational development, and aims to help educational developers to reflect on their educational activities, in order to decide what direction they might move in. Several categories of activities to develop a university’s teaching and learning are identified, one of which is ‘undertaking educational evaluation’. This pinpoints one of the most important aspects of educational development: evaluation (Koek, 2021; Agrawal, 2004). Agrawal (2004) argues that evaluation is one of the basic elements of any educational program, and that it is crucial in determining the shape and composition of them. This goes both for incremental development as well as radical development.

Additionally, an educational development that is currently researched extensively is cooperative learning. It is demonstrated by various researchers that cooperative learning improves knowledge retention (Sia, 2015; Ghilay & Ghilay, 2015; Ruiz-Gallardo et al., 2012; Jackson & Evans, 2017). This is amplified by Tran (2014) who shows that cooperative learning broadens the knowledge retention in a certain field of expertise. Even though the knowledge base on cooperative learning is growing extensively, utilization in the classroom stays behind. Schilstra et al. (2019) identified that evaluation is an important aspect of improving cooperative learning in a higher educational setting. Abcouwer et al. (2021-1) subsequently describes an evaluation strategy to evaluate cooperative learning. Generally, it is assumed that with cooperative learning, the group is eventually more than the sum of its parts and the students performed better than they individually would have. This thought is also the promise of ecosystems, in which stakeholders support and strengthen each other, in order to achieve more than they individually could have.

It is questioned whether ecosystems can play a role in the facilitation of life-long learning and whether evaluation strategies currently applied in higher education are suitable for the evaluation of life-long learning. It is argued that the evaluation of life-long learning involves a wide variety of stakeholders, which means that coordination and alignment is essential. Therefore, the goal of this research is to discuss the role of evaluation in the upcoming educational era of life-long learning, and to investigate the opportunities that ecosystems offer in relation to this topic. The accompanying research question is:

*How can ecosystems facilitate life-long learning to deal with disruptive change?*
This research question will be discussed and an answer will be proposed based on an analysis using the ACoR model (Takács et al., 2020). The three main focus areas of this research are integrated from the perspective of long term thinking and the uncertainty and turbulence that we are and will be dealing with. A suggestion is made as to how an ecosystem can be adopted to facilitate life-long learning, along with a proposition on the role of cooperative learning and evaluation. This will increase the societal and organisational ability to deal with disruptive change like COVID-19.

2 The inevitable role of life-long learning and cooperation

In society, two movements can be identified. On the one hand, the challenges we face are getting bigger and are constantly changing. As discussed in the introduction, this calls for a life-long learning strategy integrated in education. On the other hand, the challenges we face are getting more complex. As discussed in the introduction, engaging in cooperative learning means the group eventually achieves more than the sum of the individual parts (Schilstra et al., 2019). With challenges getting more complex and uncertain, it is essential to engage in cooperative learning in order to be able to manage these challenges. This section will introduce the concept of life-long learning, the role of cooperative learning, the Adaptive Cycle of Resilience (ACoR) model and the concept of ecosystems.

Life-long learning

Since the nineties, the number of research articles on life-long learning has been growing steadily. In the period of 1990 to 1995, around 21,000, while in the period of 2010 to 2015, around 323,000 articles have been published. It is clear that the academic interest regarding the concept of life-long learning has been growing steadily.

McCombs (1991) already stated that in order to meet certain future (21st century) needs, one needs to constantly improve. She delved into the possibilities of life-long learning and combined it with motivation. Motivation in the sense that one needs to convey to learners in order to promote life-long learning attitudes and skills. The role of adult educators is further elaborated on by Candy (1991), who presents a three-part model that can be used by adult educators to enhance people’s self-directedness. The general consensus was that educators attribute to developing attitudes of life-long learning in learners. Collins (2009) summarizes this as “Lifelong learning is attitudinal—that one can and should be open to new ideas, decisions, skills, or behaviors. Skills for lifelong learning relate to the need to acquire, process, and transfer knowledge. Lifelong learners need to be able to determine what they need to learn and how to make and carry out a learning plan. They need to know how to locate appropriate information, evaluate its quality, organize it, and use it effectively. They need to be critical and creative thinkers, problem solvers, and decision makers, and they need to practice regular self-reflection”. The role of educators, or education in general, has been exemplified by the many handbooks and research articles on education techniques for life-long learning. For example, Collins (2009) outlines the traits and skills of life-long learners and suggests learning activities to develop these traits and skills and eventually establish a life-long learning attitude. The role of educators is thus to develop attitudes of life-long learning and with that prepare learners for life-long learning, or a life full of learning. This poses an interesting and possibly problematic question: while life-long learning lasts a lifetime, how would one evaluate this?

From a societal perspective, the need for life-long learners is undeniable. The society shifts from certainty to uncertainty (Gigerenzer, 2014). Figure 2 outlines this shift and identifies the different steps when dealing with a problem (Takács et al., 2019-1).
In a situation of certainty, problems are often well-defined, and solutions are known. Currently available knowledge can be used. However, in a situation of uncertainty, the problems we encounter are either unknown or ill-defined. This means that solutions are also unknown (Takács et al., 2019-1) and new knowledge for the future is required (Abcouwer et al., 2021-2). This requires us to constantly develop ourselves, which demonstrates the need for life-long learning.

The need to learn and develop ourselves can partly be attributed to the situation as described above. However, the motivation to learn also increases when certain needs are met. According to McLeod (2018), there are two types of needs: growth needs and deficiency needs (figure 3).

Figure 3. Maslow’s motivation model (adopted from Abcouwer et.al., 2021-2; McLeod, 2018)

Growth needs will constantly arise in society, and an individual as well as society as a whole needs to be able to meet these needs. The role of educational institutions in this setting is realizing the switch from decreasing motivation to increasing motivation and guiding students in this process. This will yield life-long learners. From an educational perspective however, the situation is relatively problematic. Traditional education is often still centered around the transfer of existing knowledge (figure 4).

Figure 4. Traditional learning and education (Abcouwer et.al., 2021-2).

Some aspects of traditional education and educational activities actually contribute to the development of life-long learning, but this is currently not the main focus, rather a positive by-effect. This is reflected in the fact that education techniques for life-long learning have been underutilized in higher educational programs (Collins, 2009).
Cooperative learning

Until now, the notion of learning is often associated with the individual, where knowledge transfer takes place from source to receiver, and it is assumed that this will yield smarter people (figure 4). For life-long learning, the same is applicable: an individual must develop a life-long learning attitude and be able to apply this in life. This could, however, also be seen from a broader perspective. It is argued that society as a whole should develop life-long learning attitudes. Many of the societal problems at hand right now cannot be solved by one person only. Instead, they require cooperation. This reveals the relevance of cooperative learning, and that life-long learning is not something that one does individually, but together with others.

In this paper, the definition that has been suggested by Schilstra et al. (2019) is leading. They assume that cooperative learning is “the comprehension and innovative use of knowledge in a team effort, where all members work together and are activated in the process of maximizing their own and other’s learning”. It is important to remark that this definition does not attribute cooperative learning solely to educational institutions. Rather, it embraces the fact that cooperative learning can take place in any setting. Additionally, cooperative learning can be consciously established, while it can also be a social construct that spontaneously occurs.

![Figure 5. The learning group performance curve (Johnson & Johnson, 1999).](image)

It is often assumed that in traditional education, cooperative learning is already often applied. However, this is contradicted by research that explains that cooperative learning is often underutilized in the college classroom (Faust & Paulson, 1998; Buchs et al., 2015). This discrepancy might be explained using the learning group performance curve that is described by Johnson & Johnson (1999) (figure 5). They argue that different kinds of learning groups are distinctly different, which is reflected in their performance.

The pseudo-group and traditional classroom group can be recognized in traditional (higher) education. A cooperative learning group works together towards shared goals and the group is eventually more than the sum of its parts and the members performed better than they would have individually. A cooperative learning group becomes ‘high-performing’ whenever the commitment towards the group’s success and towards the other members is higher, which results in the group performing better than predicted. Evidently, this is the desired result of cooperative learning and the attitude that is needed when engaging in cooperative life-long learning. Recurrently, it is presumed that implementing ‘group work’ in traditional education results in high-performing cooperative learning groups, while it often does not.

As a tool to successfully implement cooperative learning in a higher educational setting, Schilstra et al. (2019) developed a framework focusing on factors that are relevant in the implementation of cooperative learning, categorized in four themes: preparation, facilitation, evaluation and climate (figure 6). This model is specifically applicable to the organization of cooperative learning groups in higher educational courses.
Preparation is concentrated around establishing the needed aspects for the actual cooperative learning process, for example goals, scripts and plans. Facilitation is a broader aspect that focuses on for example guidance, feedback, critical thinking, decision-making opportunities and monitoring throughout the cooperative learning process. Evaluation specifically identifies the strengths and shortcomings in the cooperative learning process. Naturally, the cooperative learning process takes place in a certain climate. Important aspects in this respect are for example open communication, active engagement, no hierarchical arrangement and members should feel safe and respected. Using this model, one can consciously establish (high-performing) cooperative learning groups. In the current way of working in education this is the role of higher education: developing not only an individual life-long learning attitude, but also a correct and useful cooperative learning attitude people can take advantage of in society.

Many aspects of the cooperative learning model that are described by Schilstra et al. (2019) can be recognized in the definition of life-long learning. This is outlined in the results section. While life-long learning can benefit from the characteristics of cooperative learning, the question is raised how this cooperative way of working can be achieved in life-long learning.

Adaptive Cycle of Resilience

Considering the Covid-19 pandemic and other unforeseen developments in society, individuals, organizations, governments and society in general needs to act resilient. There are many ways of thinking about this problem, and on how people can actually achieve this. In that sense, the ACoR model (Tákacs et al., 2020) may prove to be useful. This section will summarize the ACoR model (figure 7) and outline its relevance in this topic.
to rethink the balance between the want-must-can dilemma. Change is a continuum with multiple and repeating phases, which is reflected in the cycle. One of these phases is **Equilibrium**, in which relatively small and comprehensive problems or disturbances may occur. These can be dealt with using the known ways of working. Whenever an external influence severely disrupts the organization, it is pushed towards the **Challenge** phase. Here, the known ways of working are no longer sufficient, and the organization is compelled to look for new solutions, appropriate competencies, attitudes and skills that will lead the organization to **New combinations**. Here, the choices are made as to which solution is the most suitable. This solution is subsequently operationalized in the **Operationalization** phase. The final choices are often made without sufficient knowledge about the success of the solution. From here on, there is full support for the assumptions, intuitions and gut feelings that were involved in the choice, and the solution is scaled up towards a new Equilibrium. That means that the new situation is different from the old one. Holling (1996) and Gunderson et al. (2010) argue that the extent to which it has the ability to achieve a new, and with that different, business-as-usual situation (equilibrium) determines the success of an organization. In general terms, the left two quadrants of the model are subject to a more stable and clear environment (we know what to do), while the right two quadrants of the model are subject to a more chaotic and complex environment (we do not know what to do).

Tákacs et al. (2020) also outline that in the left two quadrants, the role of teams is inherently different from the role of teams in the right two quadrants. In a more chaotic and complex environment, teams need to be led by a creative manager, and need to be free to experiment in scenario-based learning. It is argued that (high-performing) cooperative learning groups are substantially more important in the right two quadrants, since the situation is not suitable to simply divide tasks and get to work. This while the left two quadrants allow for a structured (may it be complicated) approach.

**Ecosystems**

The concept ‘ecosystems’ has been spreading rapidly across the globe. It has gained in popularity in academic research, industry, policy and management (Audretsch et al., 2018). The number of studies focusing on ‘ecosystems’ has grown exponentially since 2000-2004 (figure 8).

![Figure 8. Studies focusing on 'Ecosystems' (Audretsch et al., 2018).](image-url)

In the years after, many authors discussed on the question of definition. Audretsch et al. (2018) have examined this, and describe that the literature on ecosystems is subject to a lack of development, and continuous inconsistency. The concept of an ‘ecosystem’ is often considered to be some kind of special network. Moore (1998) describes the rise of a new corporate form: business ecosystems. Other forms of ecosystems include, but are not limited to, digital ecosystems (Sussan and Acs, 2017), university ecosystems (Hayer, 2017; Wright et al. 2017; Meoli et al. 2017; Colombelli et al. 2017) and financial ecosystems (Cumming et al. 2017; Ghio et al. 2017). Entrepreneurial ecosystems and innovation ecosystems are described by Audretsch et al. (2018). Each form of ecosystem has its own speciality, and the members and stakeholders within the ecosystem are involved in realizing the shared goals of the ecosystem.
It is often discussed to what extent ecosystems naturally arise or whether they are the result of careful planning and structuring. The concept of ecosystems is widely used to describe structures in the social environment that naturally came into existence, a mechanism to analyse these social constructs. However, in the more recent literature, the concept of ecosystems is associated with carefully constructed environments to facilitate some kind of predefined shared goal. Members and stakeholders are actively recruited and integrated in the ecosystem. This way of working can be seen as an extension of the classic network-organization structure, in which organizations cooperate in a network: the stakeholder awareness (Scharmer and Yukelson, 2015). To be more precise, Scharmer and Yukelson (2015) explain a matrix of social evolution, in which four fields of awareness, and four social system levels are depicted (table 1).

<table>
<thead>
<tr>
<th>Field</th>
<th>Structure of Attention</th>
<th>Micro Attending (individual)</th>
<th>Meso Conversing (group)</th>
<th>Macro Organizing (institutions)</th>
<th>Mundo Coordinating (global systems)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitual awareness</td>
<td>Listening 1:</td>
<td>Downloading:</td>
<td>Centralized control:</td>
<td>Hierarchy:</td>
<td></td>
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<tr>
<td></td>
<td>Downloading habits of</td>
<td>Speaking from</td>
<td>Organizing around</td>
<td>Commanding</td>
<td></td>
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<tr>
<td></td>
<td>thought</td>
<td>conforming</td>
<td>hierarchy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecosystem awareness</td>
<td>Listening 2:</td>
<td>Debate:</td>
<td>Divisionalized:</td>
<td>Market:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Factual, open-minded</td>
<td>Speaking from</td>
<td>Organizing around</td>
<td>Competing</td>
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<td></td>
<td></td>
<td>differentiating</td>
<td>differentiation</td>
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<tr>
<td>Stakeholder awareness</td>
<td>Listening 3:</td>
<td>Dialogue:</td>
<td>Distributed/networked:</td>
<td>Negotiated Dialogue:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Empathic, open-hearted</td>
<td>Speaking from</td>
<td>Organizing around</td>
<td>Cooperating</td>
<td></td>
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<td></td>
<td></td>
<td>inquiring others, self</td>
<td>interest groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecosystem awareness</td>
<td>Listening 4:</td>
<td>Collective Creativity:</td>
<td>Ecosystem:</td>
<td>Awareness Based Collective action:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generative, open-presence</td>
<td>Speaking from what is moving through</td>
<td>Organizing around what emerges</td>
<td>Co-creating</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Matrix of social evolution: four fields of awareness; four system levels
(adopted from Scharmer & Yukelson, 2015).

The fourth field of awareness is ecosystem awareness. The authors argue that the development of social systems “participants and stakeholders evolve through four stages and structures of engaging with the social field: as a habitual pattern (level 1), as a transactional frame (level 2) as a relational web of connections (level 3) and as a landing strip that allows the emerging future to become present (level 4: presencing)”. In the sense of establishing a rewarding and strong ecosystem, members need to go through these stages in order to develop ecosystem awareness, which is essential to be able to engage in co-creation (table 1).

Scharmer and Yukelson (2015) identify five stages that are required to transform and shift the level of awareness from which they are operating: co-initiating, co-sensing, co-inspiring, co-creating and co-shaping. The first three is about finding common intentions within a group, and adopting new perspectives and identifying and connecting to the deeper sources of knowing. Co-creating is about acting or doing to explore the future. Here, rapid-cycle prototyping and testing is relevant, which is exemplified by Takács et al., 2019-1 who argue that a chaotic and uncertain situation requires scenario based learning and the sequence of act > sense > probe. Co-shaping is about evolving the ecosystem in a sustainable and scalable way. This is often an iterative process that requires the stakeholders to constantly assess changes in the personal, the relational and the institutional. Co-shaping demonstrates the relevance of evaluation in an ecosystem.

What goes for an ecosystem in nature can be applied to an established business or innovation ecosystem: all the parts actively work together to create a balanced system, at some point maybe even self-regulating. This is exemplified by Audretsch et al. (2018) who argue that “ecosystems are by definition characterized
by cooperation and network externalities”, which demonstrates the relevance of cooperative learning and working in an ecosystem.

3 Integrating concepts

In this section, the concepts, terms and ideas that have been discussed in the previous section will be integrated. A framework that depicts the role and dependencies of the various factors and stakeholders within a learning ecosystem will be established and explained.

First, we have learnt that society requires learners, not doers. In society, we increasingly find ourselves in uncertain situations, in which we do not know the solutions to the problems we encounter. When looking at the ACoR model as discussed in the previous section, the challenges we face require new combinations, ways of working we do not know yet. Traditional education is often concentrated on preparing students for a certain and stable situation (left two quadrants), while life-long learning strategies can equip learners with an attitude that is necessary for an uncertain and complex situation (right two quadrants).

In search for a new equilibrium, we must escape the boundaries of the current situation, and cooperatively acquire and process knowledge, learn new skills and acquire new competencies. The right two quadrants of the ACoR model are associated with complexity and uncertainty. In organizations, this requires managers and teams to engage in creative thinking and problem solving. In society, all stakeholders are required to do the same. This also means that regular evaluation strategies that are in place are not sufficient. In the left two quadrants of the ACoR model, the certainty and stable situation allows the development of standardized evaluation strategies. However, the right two quadrants require different evaluation strategies. It is not clear what needs to be evaluated and how evaluation strategies should be shaped. Moreover, when looking at society as a whole, stakeholders are often far apart, which hampers cooperation and evaluation of the integral societal situation. In this respect, the role of Information Systems (IS) and ICT is also inevitable. IS and ICT enable us to exchange information and knowledge. Technology is the enabler in the knowledge society or knowledge economy. It is therefore imperative to teach and learn students about the practical application of IS and ICT, and its relevance in solving the complex challenges we face now and in the future.

Secondly, we have learnt that life-long learning and cooperative learning go hand in hand. They are complementary to each other and higher results can be achieved when life-long learning is seen as a cooperative learning process. This is especially true for individuals that have similar learning needs. In order to realize this, two aspects are essential for an individual or organization to develop and maintain: a cooperative learning attitude and a life-long learning attitude. For the individual, the role of education is clear. Education, at any level, should integrate strategies to develop life-long learning attitudes. These strategies should focus on (figure 9):

- developing an open mindset, which is also relevant in ecosystems (Scharmer and Yukulson, 2015);
- skills to acquire, process and transfer knowledge;
- the ability to determine learning needs and to develop and carry out a learning plan accordingly;
- skills to locate information, evaluating its quality, organizing and using it;
- skills related to creative thinking, problem solving and decision making;
- the ability to effectively practice self-reflection.

Additionally, a cooperative learning attitude must be developed. This consists of two aspects. On the one hand, learners should appreciate the relevance of cooperative learning in any setting. On the other hand, learners should practice cooperative learning experience what a (high-performing) cooperative learning group is and be able to distinguish it from a traditional classroom group.
Educational institutions should not only use the cooperative learning factors (preparation, facilitation, evaluation and climate) during a cooperative learning process, but should also make these explicit. This way learners can take these lessons and apply them in society after finishing their educational program. Additionally, as discussed earlier, the skills to locate, evaluate, organize, acquire, process and transfer information and knowledge can be supported by means of IS and ICT. In order for cooperative learning to work, tools that are often based on technological advances must be implemented. Integrating this in educational programs enables students to successfully operationalize their cooperative (life-long learning) attitudes.

Thirdly, we have learnt that ecosystems are eminently suited to facilitate flexible adaptive cooperative learning and working. In the context of this paper, the concept of ecosystems was used to carefully plan and construct an environment in which stakeholders actively work together. Engaging in an ecosystem makes the members more resilient because of the mutual dependency and cooperation within the environment. This is reflected in stronger ties between the stakeholders compared to a regular network setting. Especially in the current times that we live in, with many stakes and stakeholders, and the rapidly changing environments and the challenges it brings, it is important to be able to work together. This is exemplified using the ACoR model, in which the focus in the right two quadrants is on cooperation and co-creation. Scharmer and Yukelson (2015) show that engaging in an ecosystem requires ecosystem awareness, which is established by going through the four stages and structures of engaging with the social field. On a macro and mundo level, one can speak of an ecosystem.

Figure 10 depicts the discussed elements in a proposed integrated ecosystem architecture. Firstly, it depicts the individuals, teams, organizations and educational institutions that are stakeholders in the era of life-long learning. Secondly, the aspects of cooperative learning are integrated. Preparation functions as the onboarding phase in which participants are prepared for the cooperative life-long learning process in which they will play an important part. Here, life-long learning attitudes and cooperative learning attitudes are brought to the desired level. Additionally, participants are subjected to the five stages that are required to transform and shift the level of awareness they are operating from: co-initiating, co-sensing, co-inspiring, co-creating and co-shaping (Scharmer & Yukelson, 2015). Within the ecosystem, tools and mediums facilitate the cooperative processes.

Lastly, four forms of evaluation are included: after preparation (yellow), centralized (blue circle), decentralized (blue signs) and during offboarding (green). As discussed before, self-reflection is an important aspect of the life-long learning attitude, and forms the basis for regular decentralized evaluation, which is imperative for both individuals, teams, organizations and educational institutions. The earlier mentioned course evaluations, or for example regular organizational audits may be seen as decentralized evaluations. An additional centralized evaluation framework must be established and integrated in an adaptive way, so that it matches the participant or stakeholder. Firstly, centralized evaluation permits monitoring the functioning of the ecosystem within society (top and bottom). Secondly, centralized evaluation facilitates that the learning and working climate within and outside the ecosystem can be monitored. Lastly, the cooperation ties between the nodes in the ecosystem can be monitored by means of...
a centralized evaluation strategy. This four-fold evaluation structure establishes a certain resilience in the ecosystem since the ways of working are monitored and can be adapted if any (unforeseen) disturbances in society or the ecosystem are detected.

4 Conclusion

We live in turbulent times, in which the world is constantly changing and facing us with challenges to which we do not the solutions. COVID-19 forms a clear example of this development. To be able to react properly on this type of development life-long learning forms a crucial element in this. It requires us to rethink our learning structures. In this light, two questions were raised. One, how do we make sure we are prepared for unforeseen events like COVID-19? And two, what is the role of evaluation in the process of preparing for the unknown? The leading question in this discussion paper was: How can ecosystems facilitate life-long learning to deal with disruptive change? In this discussion paper, four inherently related concepts were brought together: life-long learning, cooperative learning, the Adaptive Cycle of Resilience (ACoR) model and ecosystems. These main concepts were structured into a proposed integrated ecosystem architecture to facilitate life-long learning, which contributes to laying the foundation of the development of ecosystems in which life-long learning is the main objective.

First, traditional education is found to be not sufficient in developing the necessary life-long learning attitude. The role of education in the proposed architecture is two-fold. On the one hand, education plays a major role in preparing learners for participation in the ecosystem. Here, the focus is on developing life-long learning attitudes and cooperative learning attitudes. On the other hand, educational institutions must be integrated into the ecosystem as participants.

Secondly, the role of cooperative learning remains substantial, if not bigger. Engaging in cooperative learning results in the group eventually achieving more than the sum of the individual parts. This is considerably relevant in a life-long learning ecosystem. Ecosystems can be seen as complex network settings, with strong ties between members. As discussed, ecosystems are by definition characterized by
cooperation and network externalities. Naturally, this means that working in an ecosystem is highly related to cooperative learning.

Thirdly, the role of evaluation in a life-long learning ecosystem is four-fold: after the preparation or onboarding phase, centralized, decentralized and during the offboarding phase. This four-fold evaluation structure establishes a certain resilience in the ecosystem, since the ways of working are monitored and can be adapted if any (unforeseen) disturbances in society or the ecosystem are detected.

In conclusion, for a more successful integration of life-long learning in a societal context, the proposed integrated ecosystem architecture can be a helpful mechanism. Cooperative learning must be taken into account, and evaluation strategies must be constructed, in order to facilitate the four-fold evaluation approach. In general, the turbulent times we live in require us to constantly adapt to changes in society. This requires learners, not doers. Establishing an ecosystem to facilitate cooperative life-long learning will enable us to be resilient and adaptable in challenging times in the unforeseen future.

In relation to this conclusion, several aspects demand further discussion or research. First, the application of consciously constructed ecosystems in relation to life-long learning must be further investigated. To that end, a group of around seventy IS Master students will take advantage of a research project to investigate the opportunities and challenges of implementing ecosystems to facilitate life-long learning. This discussion paper functions as a first step towards this project. Secondly, evaluation strategies for the proposed four-fold evaluation structure must be developed. Thirdly, the factors related to the implementation of cooperative learning must be examined in regard to an ecosystem setting. These factors were originally focused on cooperative learning groups consisting of individual learners. An ecosystem is distinctly different from a regular cooperative learning group. Therefore, the implementation factors should be transferred from a regular cooperative learning setting to a life-long learning ecosystem. Lastly, since the role of education in the proposed architecture is two-fold, a new way of looking at the development of attitudes of life-long learning is required.

5 References


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