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# How can the synergies between the pillars of the knowledge square be optimised? A knowledge spiral approach in the context of EURECA-PRO

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## Summary

This article uses Nonaka's knowledge spiral concept to analyse the activation of the knowledge square as conceived and implemented in work package #4 (WP4) of the EURECA-PRO 2.0 European University Alliance, focusing on SDG12, Responsible Consumption and Production. It presents actions fostering research, innovation, transformative services to society and training, and analyses the potential for synergy between these four pillars based on the four phases of Nonaka's SECI model (Socialisation, Externalisation, Combination, Internalisation). It shows the need to move from the static concept of the knowledge square to the dynamic concept of the knowledge spiral, and outlines recommendations for steering WP4.

## Keywords

knowledge square - SDG12 - responsible consumption and production - knowledge spiral - tacit knowledge - SECI model - European University - EURECA-PRO

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How can the synergies between the pillars of the knowledge square be optimised? A knowledge spiral approach in the context of EURECA-PRO

In its conclusions of June 28, 2018, the European Council stressed the need to "foster cooperation between research, innovation and education, including through the European Universities Initiative" [1]. Before 2020, the European Commission was using the term "knowledge triangle", which is understood as the close interaction between education, research, and innovation. With an increased focus on universities' role for service to society, this evolved into higher education institutions being presented as central players in the "knowledge square" [2]. This applies of course to the expectations raised with the European Universities initiative.

In its second phase, the EURECA-PRO European University, dedicated to SDG 12 "Responsible Consumption and Production", devotes one of its five Work Packages to "activating the knowledge square". The term "activation" refers here to the idea of exploiting and optimising the synergies between the four vertices of the square, so as to avoid that the square becomes a

mere juxtaposition of silos. Among other examples, research must be able to inspire innovation, not just through the direct transfer of research results (the classic "TRL ramp-up" approach), but more broadly by opening up new prospects for products, processes or global models for organising economic and social activity. It must also be able to offer new educational content and help to enlighten citizens and political decision-makers; innovation must give rise to new teaching approaches favourable to creativity or to taking societal challenges into account, just as training based on concrete projects (challenge-based training) directly enriches innovation ecosystems. Similarly, the values and vigilance expressed by citizens must in turn guide research and innovation, and form an integral part of the skills and awareness provided by educational curricula. Combinations of this type are numerous, and probably endless if we go into the details of the possible synergies. Nevertheless, none of these promises of a virtuous circle can be realised if the four pillars operate independently. The aim of the EURECA-PRO project is to identify and realise these synergies by bringing the four pillars together in a single work package, which in turn will be able to feed into the other work packages, in particular

the one devoted to education and the one devoted to the dissemination of knowledge.

The question nevertheless arises as to how to proceed to activate the knowledge square. From an operational point of view, it seems essential to enable cross-functional thinking, for example by bringing together the leaders of each of the pillars within a single coordinating body. However, it may be fruitful to strengthen this operational approach by drawing on the proposals of theoretical models devoted to the dynamics of knowledge emergence. With this in mind, we propose to read the knowledge square, particularly in the context of EURECA-PRO, in the light of Nonaka's knowledge spiral model [3] [4] [5] [6] , which sees the creation of knowledge as a "spiral" set in motion by the dynamics of multiple conversions between tacit and explicit knowledge. Although this model was originally designed for organisations, it may also prove inspiring at the level of a European university and its connections with society.

We will begin by presenting the knowledge square as conceived in EURECA-PRO, before outlining Nonaka's knowledge spiral model. We will then proceed to a cross-reading, enabling us to move from the "square" to the "spiral" of knowledge, and likely to lead to the identification of synergy levers.

### 1. The square of knowledge according to EURECA-PRO

In EURECA-PRO, we have given the process of activating the knowledge square the generic name of "project factory". This name reflects the philosophy behind its conception, which is closely linked to the prospect of a European university, that aims to create a common educational momentum around SDG 12 (Responsible Consumption and Production). To this end, the aim has been to take full advantage of the collective formed by the alliance to activate the synergies between the four pillars, and put them at the service of transformative research, innovation and services to society projects geared towards SDG 12. This momentum involves a wide range of players, going beyond EURECA-PRO's partner universities: other academic partners, industrial partners, public policy players and society at large as a whole.

Logically, the EURECA-PRO knowledge square is based on four objectives corresponding to each of the pillars. The first objective is to strengthen the academic community by developing joint research focused on SDG 12, the second objective is to position EURECA-PRO as a key European player in the innovation ecosystem specific to circular economy, the third objective is to convey the voice and expertise of the community represented by EURECA-PRO to political decision-makers, associations and citizens, while the fourth objective is to mobilise the various results obtained to irrigate educational practices with new educational content and new methods (see Table 1).

Objective 1	Objective 2	Objective 3	Objective 4
Research	Innovation	Third-Mission	Education

<p>A common, open data platform - making it possible to list the alliance's expertise and available resources</p> <p>Concrete research cooperation on an interdisciplinary basis and at a European scale, leading to the emergence of a few flagships that will determine the DNA of the alliance in terms of RCP.</p> <p>Contribute to the dissemination of the results of the research undertaken, and position itself as a reference player in RCP research, in particular by expanding the scope of the International Conference on RCP initiated in phase 1</p>	<p>Clearly position the alliance as an "honest broker" for a network of RCP innovation players.</p> <p>By using the platform of skills and research activities mapped out, set up an innovation cluster to identify opportunities and needs.</p> <p>Provide testing grounds for innovation in RCP, in particular through a SDG 12 Living Lab.</p> <p>Hub to foster the emergence of a pan-European vision</p>	<p>With the academic, economic and political partners identified, set up a think tank to deliver advice to public policy decision-makers</p> <p>Host a series of events aimed at different audiences, to shed light on economic and political issues and raise awareness of the challenges of SDG 12 among the general public.</p>	<p>Transform the results of the project factory into resources (content and methods) for education and training</p>
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### 2. Nonaka's SECI model.

The goal of the SECI model is to explain the process of knowledge creation within a community of players, such as a company. It differs from a rationalist, linear model in that it places great importance on experience and tacit knowledge. Inspired by Michael Polanyi, Nonaka takes up the idea that much of what individuals know is not made explicit or even explicable: "There are things that we know but cannot tell" (Polanyi, 1962). According to Nonaka, this does not lead to a dead end, but rather to a change in perspective of the knowledge creation process, taking into account both tacit and explicit knowledge. From this starting point, Nonaka devised a four-phase model.

The first phase is the *socialisation* phase, during which individuals working together exchange tacit knowledge. For example, if researchers from different disciplines work together on an interdisciplinary project, they will each have access to new ways of thinking, and will take into account new questions or new variables, without being able to mobilise this new knowledge themselves, or even being able to explain what they have learnt. During this phase, the nature of the knowledge will not

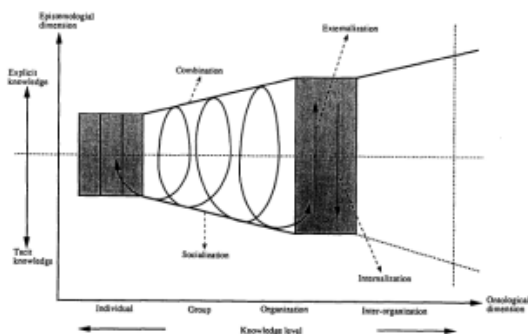
have changed (it will remain tacit), but it will have taken on a collective dimension.

The second phase is the *externalisation* phase, and corresponds to the conversion of tacit knowledge into explicit knowledge, through the drafting of procedures or documents, or the encoding of knowledge in digital systems. This is what will happen, for example, if our researchers decide to write a summary of what they have learned at the end of an interdisciplinary conference. Part of what they have learnt during the socialisation phase will have been transcribed into an explicit form and will now be accessible to others.

This externalisation phase in turn generates another phase, that of *combination*. Knowledge that has been made explicit can be combined with other sources of explicit knowledge, leading to the deepening of knowledge by highlighting divergences or complementarities between the different types of knowledge made visible by the explicitation process, which constitute sources of reinforcement for pre-existing ideas or new questions. In this way, the summaries produced by our researchers can be compared with each other, with other articles, with manuals, or with the experience of other types of players, such as professional or institutional partners.

This combination phase thus produces new knowledge, which is always explicit in nature. This knowledge takes on a tacit nature when individuals appropriate it in their actions and develop new personal experiences incorporating the knowledge that has emerged in the combination phase. This last phase is the *internalisation* phase, and is the prelude to a new phase of socialisation.

Figure 1: representation of Nonaka's knowledge spiral – figure copied from [8].



As shown by Figure 1, this cycle is unbroken and is a possible representation of the way in which knowledge is produced and accumulated, as part of a self-perpetuating dynamic. This is why Nonaka uses the metaphor of a "spiral of knowledge", which never stops circulating and rising. The figure also shows that this spiral enables different levels to be interconnected (individual - collective - organisational - inter-organisational).

Summarised very briefly here, the SECI model may provide some interesting food for thought in terms of how to set the square of knowledge in motion, to move in

some way from a square representation to a spiral representation in Nonaka's sense.

### 3. From the square to the knowledge spiral?

How can the SECI model enable better activation of the square of knowledge, and more specifically in the context of EURECA-PRO? Firstly, we need to ensure that each of the phases of the model can be achieved through the actions foreseen under the four objectives. Secondly, we need to look at the organisational and operational arrangements that can facilitate and even optimise the knowledge spiral.

The socialisation phase refers to the situations in which different actors involved in SDG 12 will be led to work together within the framework of EURECA-PRO, whether they come from the Alliance partners or from outside. As far as the socialisation phase is concerned, joint research, in particular via the flagships (objective 1) and the network of innovation players (objective 2), are probably the best opportunities for different players to share their tacit knowledge through their joint work. We can imagine interdisciplinary scientific exchanges around SDG 12, but also exchanges between players from the academic world and players from the economic world. As far as the externalisation phase is concerned, the platform of skills and joint research (objective 1), the innovation cluster and the mapping of activities (objective 2), the think tank for public decision-makers (objective 3) and the design of educational content (objective 4) are all moments of formalisation that make it possible to give an explicit and collective nature to knowledge, that was previously individual and tacit. It also seems that the development of a recognised international conference (objective 1) is one of the events intrinsically dedicated to combining knowledge from various sources, as is the Innovation Hub (objective 2) or events aimed at society as a whole (objective 3). These events are, by their very nature, places for debate where new horizons are forged through the confrontation of ideas and opinions, which will be all the more opposable to one another as they will have been made explicit, and consequently made accessible to any individual wishing to take an interest in the subject of SDG 12. Problem-based learning approaches can be seen as the pedagogical counterpart of this combination phase, insofar as they organise the meeting of different stakeholders around a single identified problem (objective 4).

The internalisation phase is more difficult to identify, and may not be linkable to a precise objective. It probably escapes the direct actions of EURECA-PRO, insofar as it depends on the way in which individuals (researchers, industrial partners, students, citizens, political decision-makers, etc.), at the end of a cycle of the spiral, will seize the knowledge produced and transfer it into their own activities. The most that can be said is that EURECA-PRO and more specifically its WP4 are creating an environment that is favourable and conducive to such appropriation, the effectiveness of which can be enhanced by follow-up and support measures. This last phase therefore presupposes that more attention is paid to monitoring actions so that the knowledge produced is

mobilised, tested and transformed through experience, and can feed a new cycle of the spiral.

It therefore appears that, from the outset, the square of competence integrates the various levers conducive to its activation in the form of a spiral of knowledge, which gives a temporal dynamic to a static concept. While the mechanisms exist, the SECI model approach requires us to pay particular attention to three dimensions during the course of the project:

- The first is to ensure that each device fulfils the tacit/explicit conversion mission that it is likely to fulfil. For example, the conference can only fulfil its role as a combination if it is a forum for debate and confrontation, rather than a juxtaposition of presentations.
- The second is that the interfaces between the actions are effective, at the risk of interrupting the spiral cycle. For example, if the results of joint research are not communicated, this compromises the externalisation/combination link. It also seems important at this stage to ensure that the relationships are two-way. For example, if research does not feed on debates with society or decision-makers, the internalisation phase will lose its quality.
- The third is to highlight the profoundly dynamic and processual nature of the knowledge spiral. This means that monitoring actions over time is at least as important as checking

deliverables at a given point in *time*. For example, it is important that feedback from the various actions is integrated on an ongoing basis to enable complete learning loops.

## Conclusion

EURECA-PRO has conceived its "project factory" as a means of activating the square of knowledge as presented in the European Commission framework. In more precise terms, the idea here is to seize the opportunity provided by the construction of an educational offer centred on SDG 12 at the European level, to initiate a virtuous circle between the different pillars of knowledge and to feed off its results. Based on Nonaka's SECI model, we have highlighted the temporal and processual dimensions of the relationship between these four pillars and the need to take them into account when managing the project factory. In other words, this invites us to move from the square of knowledge, a static concept, to the spiral of knowledge, a dynamic concept. From an operational point of view, this leads us to adopt a knowledge management perspective, focusing our attention on the way in which knowledge, in its tacit and explicit forms, circulates and feeds into each other, both through actions relating to each of the four pillars and through the involvement of all the categories of players involved.

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