

FUTURES LITERACY KNOWLABS IN FUTURE-ORIENTED TECHNOLOGY ANALYSIS

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Abstract

The purpose of this paper is to demonstrate how Futures Literacy Knowledge Laboratory (FL Knowlabs), which is being currently developed by UNESCO with a growing group of international contributors, is novel way of generating knowledge in the FTA process. FL Knowlabs, systematically deployed worldwide, address the future-oriented issues close to the heart of local, regional and global communities of practice. By challenging assumptions underlying the visions about the future and helping to embrace complexity, these workshops should serve as a foundation or opening step in Future-Oriented Technology Analysis (FTA) projects regardless of their size or scope. They are also an important way to learn about the ways specific groups of interest use the future. This paper will explore particular applications of FL Knowlabs.

FL Knowlabs are co-designed with, and organized for, communities of practice around the world. Thus far, FL Knowlabs have been organized i.a. in Baku (Azerbaijan), Paris (France), Rio de Janeiro (Brazil), Oslo (Norway), and Freetown (Sierra Leone). Themes included the future of universities, the future of science, the future of innovation, among others. Hence, the approach has been implemented in practice to support both policy making and strategy processes in diverse cultural, geographical and thematic projects.

Specifically, FL Knowlabs bring to fore the following outcomes:

- a) new insights on a major policy issue (innovation, science, labour markets, education, etc.);*
- b) the acquisition of new and innovative methods for conducting policy-relevant research and formulating policies;*
- c) building networks locally and globally as part of a global/local conversation on how to use the future for policy making*
- d) easy establishment of local, specific framework for the collective intelligence to carry on with subsequent phases of the FTA.*

Futures Literacy (FL) is the fundamental idea behind FL Knowlabs, In practice, applied FL is the crux of the process. Like language literacy, it involves the acquisition of knowledge and skills required to visualize and use the future differently. FL is the basic knowledge and skills on how to use the future. FL assumes familiarity to tacit and explicit anticipatory processes (i.e. "optimization" (privileges causal-predictive methods and actively extrapolates the future with the past; amenable future), "contingency" (future is perceived and used to prepare an institution from possible and expected shocks) and "novelty" (making sense of emergence; the future is used to locate and create novel and innovative futures). It is also evocative of the learning process, shared by all the participants. Thus it addresses several soft spots of FTA that are, more often than not, essentials in the evaluation of FTA projects. According to Riel Miller, Head of Foresight at UNESCO, the FL focuses on the capacity to discover and invent anticipatory assumptions. This paper examines the applications of this proposition to a series of FL Knowlab cases with future research recommendations.

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Introduction

Foresight experts are disturbingly often confronted with the repetitive task of comprehensibly and convincingly explaining the scientific background of futures studies applied to strategy-making to sometimes quite visibly sceptical listeners, be it clients, partners, sponsors, or academics from other fields of expertise. It may be somewhat disconcerting to start so many conversations by explaining why our profession is a valid discipline of social and economic research. This ever-too-tedious explaining of the very basic *raison d'être* of our discipline (something unfamiliar to e.g. monetary economists, psychologists or motivation coaches) reminds emphatically about the need for comprehensibility of the means, goals and the added value of futures research. It shows a resounding need for recurrent, on-going reflection on the 'why' and 'how' we use the future for the benefit of the humankind, governments, local societies, corporate clients or NGOs. This reflection is also a mandatory activity when we try to conduct Future-Oriented Technology Analysis (FTA): Introduce new methods to develop visions, explore or challenge ideas, acquire information and data, clarify situations, negotiate solutions between actors, and justify time horizons of our studies. This paper elaborates on the subject of Futures Literacy UNESCO KnowLabs (FL UKnowlabs) - an example of such efforts. We will try to evaluate the success or failure of FL UKnowlab as a tool to improve the quality and comprehensibility of knowledge generation in an FTA process.

Methodological approach

COMPREHENSIBILITY AND QUALITY OF FORWARD-LOOKING ACTIVITIES

In our view both methodological quality and comprehensibility should be the main focus when devising any new FTA method. The need for an umbrella term like FTA, encompassing a variety of forward-looking methods, terms and practices is in itself a determinant of this challenge. Especially during the very sensitive phase of input generation during the initial, exploratory phase of any FTA process (be it foresight, futures studies, long-term planning or roadmapping) it is important to ensure that we generate knowledge in a systematic, scientifically grounded approach. At the same time we need to make the added value clear to any entity involved or benefiting from it.

Most forward-looking activities are aimed at strategy making. The major difference between traditional planning or strategizing and forward-looking activities is that the former have a starting point located in the present. They focus on the analysis of the current situation and resources. FTA and foresight, being future-oriented, have a starting point in the possible futures and work backwards from there, to translate these futures visions into current actions. With such an approach it is much easier not to be influenced and constrained by the current limitations and resources. To see a broader picture for better decision making, thus improving long-term strategies. At the same time, it is much more challenging to generate high-quality inputs when you have to rely on the analysis of *what could be* rather than *what is*. This is why the quality of inputs, which in our view can be increased by FL UKnowlabs, will be the subject of the next chapter.

The above described connection between forward-looking activities and strategy seems to work quite well in terms of increasing the comprehensibility of the added value as well as the general idea of futures studies. Additionally, the military roots of both strategy and contingency-oriented futures methodologies and the picturesqueness of war speak volumes and are universally accepted and understood. At the same time, the military analogy ridicules the inactive approach of desisting from any futures oriented thinking because of the inability to accurately predict the future. It is also a good reminder about the fact that foresight or futures studies, being a fully-fledged discipline per se, are in most cases used as an ancillary to more general strategizing (on a governmental, local, corporate or purely scientific level). The realisation of this is a positive stimulus for making the results of our research communicative and applicable to present decision-making. In other words, FTA has to be compatible with the needs of strategy development in the same way as war gaming simulation software is compatible with actual assets at hand of the Ministry of Defence.

The problem is of course not a recent one. In two RAND papers dating from the 1950s, we find evidence of a concern about the relation between forward-looking activities and strategic decision making. Let us briefly present summaries of these, still valid in the field of strategy-making, where professional futurists and futures analysts roam and try to prove their usefulness. Their common denominator is the effort to link quality of analytical work, including futures research, to strategy making.

In their research memorandum 'Ten common pitfalls' from July 1957, Herman Kahn and Irwin Mann invoke ten common mistakes of systems research progressively challenging the assumptions of expert teams thus developing future-conscious inputs to strategy. We could also call them the 10 sins of future-oriented analysis:

1. *Modelism* is the tendency to mistake models made of tacit or explicit assumptions for the complex realities. As Kahn puts it, "We have already explained that it is necessary to use idealized models which abstract essentials and make assumptions explicit. It is however, a frequent pitfall to abuse this modelizing by being more interested in the model than in the real world". This rule conforms to the general rule of social science discourse, allowing for reductionist description of the reality to facilitate embracing specificity, all other things being equal.
2. *Statistical uncertainty*. Kahn correctly asserts that "One may wish or need to treat statistical uncertainty explicitly in order to treat fluctuation phenomena accurately or to look at probabilistic objectives. Unfortunately, however, the explicit introduction of statistical uncertainty usually complicates the analysis". It is a soft way of making the point that exclusively quantitative approach to futures is a dead end at best.
3. *Real uncertainty*, which is "more a matter of taste than of calculation or investigation" underlined the fact that an important chunk of the future defies probabilistic approach, which is a truth never too often repeated and emphasized.
4. *Enemy reaction* takes into account the need for anticipating actors' responses in a way that takes account of the problem of agency and endogenous versus exogenous drivers of strategic success. Actors' future responses are a source of novelty that goes beyond the closed system vision of problems and should be treated as the main potential source of disruption.

5. *Over-concentration*, according to Kahn is also nicknamed *Assumptionitis*. "The assumptionist [suffering from this ailment], starts by assuming away the difficult part of the problem. Having made his assumptions, he spends all of his time drawing conclusions from these assumptions rather than in investigating them".
6. *Phasing*, along similar lines as over-concentration, underlines the applicability of foresight results. Kahn argues, that "One should take explicit account of the salvage value of the old system in evaluating the new designs" and that "There are large and important areas where nobody has experience". So the FTA process outputs should correspond to current environment and the distribution of assets.
7. To avoid *over-ambition* in its turn, means that "it is essential for the analyst to realize that it is important for him to stick to problems on which he really can give sound and extremely defensible advice". The task assigned to the analyst or collective intelligence should be both within their competences and at the core of the issue at stake.
8. *Fanaticism* in its turn is a sin of unconsciously following in the direction of a plausible future dictated by the collective, tacit wanting of the the expert group or decision-making body. Such future is made up of assumptions buzzing with buzzwords of the day specific to the group of experts. According to Kahn, 'almost all organizations are subject to fashion - an idea gets popular and everybody hops on the bandwagon.'
9. *Hermitism* stands for the hermetism of foresight results, making it untranslatable into the discourse of current action. FTA process has to allow for sub-studies and for larger context to be developed, should the decision-maker deem it useful.
10. Finally, the *technical standards* have to be high, but not to the point of being self defeating, because glitches occur equally out of lack of method and due to overzealousness in following a method.

Next, there is a transcript of a lecture delivered by Bernard Brodie at the Naval War College on September 18th, 1958, titled "Strategy as an Art and a Science". As early as then, Brodie argues that unchallenged assumptions are a root of defeat in strategy-making and that informed decisions require a systematic, scientifically grounded approach to assets and futures analysis. "Finally, we are immersed in bias - our own and that of our clients and readers. To the latter we adjust in unconscious or semiconscious anticipation even when we try to be honest." says Brodie, underlining the ethical and intersubjective character of input generated in a foresight project, which calls for rigour and quality control similar to the one applied to empiricist research to the greatest extent possible.

Upon examination of the recent efforts to codify the quality standards of future-oriented research both inside organizations, including corporations (Rohrbeck 2010) and on a general scale (Pereira, Schomberg, Funtowicz 2007; Gerhold 2014), one can discover that the concerns of the day are not very different from the abovementioned. In the goal to improve the quality of FTA, we build upon sixty-years-long efforts of the futures studies community to improve the quality of foresight, including the recent UNESCO Futures Literacy projects in which the authors are involved through the business practice oriented 4CF foresight consultancy and the futures research methodology oriented Polish Society for Futures Studies.

THE QUALITY OF INPUTS IN AN FTA PROJECT

Even though the solid methodological foundations of inputs generated during the initial, exploratory phase of an FTA project are a decisive factor for the quality of its results, they do not seem to get the necessary attention in many projects. This is why, when talking about improving the quality of foresight in general, we have first concentrated on improving the quality of input generation and FL UKnowlabs seemed to be a promising way of achieving that. At this point it is important to note that FL UKnowlabs are not designed as an all-in-one tool of carrying out complete foresight or futures studies projects from the early stages of goal setting until the very last stages of “shaping the future”. FL UKnowlab is positioned in the crucial and sensitive stage of generating inputs during the “exploratory” phase of foresight. We see three major factors contributing to the soundness of inputs generated in an FTA project.

Firstly, there is the methodological clarity of input generation. The methods by which knowledge is gathered and analysed should be logically consistent so that an independent evaluator should be able to follow each step of the methodology. What is more, evident steps should be taken to ensure that the whole process is unbiased and that the participants have not been influenced by e.g. suggesting a solution. These requirements are obvious in any research process claiming to have scientific foundations and there is no reason why high quality futures research should not or could not apply them. Even though in FTA it is not possible to gather empirical evidence required by the hypothetico-deductive model, this is no excuse not to follow other best practices of the scientific method.

The second pitfall of input generation is the number and adequacy of generated visions and scenarios. A common vicious circle of futures studies projects is the confusion about how many visions and scenarios should be developed. Usually, there are no clear hints on where to stop developing additional ones, or worse a set number of scenarios is imposed irrespective of what is justified by the complexity of the problem. Three or four scenarios may not be enough. Theoretically, the more the better. However, with such an approach you may end up with hundreds if not thousands of visions of the future still not knowing if you have enough to finally stop and try to make use of them, which at this point might be disheartening in itself because of their sheer multitude. Therefore, the methodology should contain clear and logical guidelines regarding the points at which consecutive parts of the process can be considered to be concluded.

Last but not least, there is the “Futures Literacy” (FL) of the contributors. Futures Literacy is a concept developed by Riel Miller describing the characteristics of a given person’s anticipatory system, meaning their intellectual and experimental capital in using the future to make decisions. The level of futures literacy of an individual or of an organization is measured by the simultaneous occurrence of three core capacities put to work in the learning process aimed at generating strategic knowledge: the narrative capacity, the collective intelligence (individual or organizational ability to undertake collective, interactive sense-making activities subject to control and management) and the capacity to reframe (Miller, 2011: 27-28). The challenge is that in governmental institutions, corporations, NGOs or even military (as noted by Brodie, 1998) the majority of people in charge of long-term strategic decision making have not gained their positions because of their outstanding qualifications in the strictly understood field of strategy or futures studies but for different and sometimes unconnected reasons. That is why we consider the educational role of increasing the Futures Literacy of participants to be an important part of an exploratory exercise. To move their anticipatory skills from tacit to explicit. It is beneficial both to the task at hand and to further development of respective organisations or groups of interest,

since the quality of data used to generate knowledge in foresight projects is dependent on the individual competences of experts (Rohrbeck 2010). Including an educational component in any FTA activity helps to manage the often mentioned risk of sliding into an incoherent futures notion framework among project participants (Schwartz, 2005).

Results, discussion and implications

This section summarizes the lessons-learned from Futures Literacy UNESCO Knowlabs (FL UKnowlab), developed and applied by UNESCO Foresight section under Riel Miller. During the course of the last 2 years over 20 (and counting) FL UKnowlabs were carried out all around the world. These case-studies, apart from the results of the workshops themselves, provide a description of the quest for improving the quality of futures-oriented research, with consecutive applications building on the experience and feedbacks from the previous ones. In our view, lessons from this quality pursuit are applicable not only to FL UKnowlabs, but to a big extent to other futures studies methods as well. The basic assumption we took is that similarly to any other FTA methods which can be considered to be of high methodological quality, FL UKnowlabs should aim to be valid from the point of view of general social science standards of logical consistency and inducing conclusions from impartial observation whenever possible.

According to Riel Miller, the author and developer of FL UKnowlab concept, “The design of the FL UKnowlab starts from the premise that everyone uses the future every day. People use the future in the sense that they develop and deploy anticipatory assumptions, from such simple ones, as the sun will rise tomorrow, to more vague ones (...). Anticipation is part of everything around us; it is a defining attribute of a universe in which time and space are in constant motion, for instance part of what defines our planet is lateness and elsewhere-ness” (Miller, 2014:3) Additionally, Futures Literacy is defined as a “self-conscious way (...) into an expanded understanding of anticipation (models, systems, processes)” (Cagnin et al., 2013:8). These sentences, recurrent in FL UKnowlab handbooks, reports and Miller’s papers imply a deductive approach to developing the new method from a conceptual framework, designed to describe in positive, clear terms some of the intricacies of futures studies. It has to be noted that in employing an exemplifying way of defining the key concepts, Miller takes a practical approach, one that can be used in presenting the conceptual framework to “futures illiterate” participants. Therefore, the claims of FL UKnowlab do not imply the goal of directly answering the strategic questions at stake, but an improvement of the capacity to rigorously and systematically converse about the future, that conversation being a cornerstone of strategizing. As a result, the FL UKnowlab addresses perfectly the knowledge gap between the usual analysts and the usual decision-makers, the latter seldom being vested in formal futures studies knowledge. Like previously noted, the power to decide on the strategy is seldom allocated on the basis of strictly understood strategy-making capabilities and comes often as a reward for merits in other fields.

To support this claim with examples from actual FL UKnowlabs performed in the field, let us stress that among participants of FL UKnowlabs under examination, the involvement of professional futurist into the conversation was either justified by the aim of method development and training (e.g. Bellagio, Baku) or limited to facilitators’ and observers’ role (e.g. Rio de Janeiro, Paris). If we consider all twenty FL UKnowlabs to date, this rule has been applied consistently, with a preponderant involvement of low futures-literate participants with medium to high decision-making capacity within the issues in question.

The next challenge that FL UKnowlab tackles is the one of input quality, crucial to the results of the whole strategy-making process. The focus on use and improvement of existing knowledge is

expressed in another passage from the FL UKnowlab handbooks: 'The common design element of the FL UKnowlab is that it follows a learning curve sequence that is intended to engage the collective intelligence of participants. The idea of collective intelligence is that everyone knows things, not always explicitly or articulately, and that when we make an effort to share meaning we are obliged to clarify and seek shared meaning. Through this conversational process information is revealed, new meanings and even phenomena invented and shared sense making emerges' (Miller 2014:3). These new phenomena and meanings in question are in fact the improvements to the state-of-the art expert knowledge, forming the base for high quality knowledge generation in an FTA process.

In practical terms, the purpose of the exercises examined in this paper have been among others: to improve the method itself and to help formulate a strategy for its deployment; to take stock of the assumptions on relationship between science and society from participants representing policy-making and research background and to feed new knowledge into existing systems of sense-making in urban studies. Although in several instances stand-alone topics had been chosen, like the futures of human habitat in Paris or the futures of coming of age in Sierra Leone, never was the ambition of FL UKnowlab as an educational and auxiliary process compromised. The output of a FL UKnowlab related to the subject of the exercise took different forms depending on the expectations of the hosting agency, but in every case it was a high-quality input to be used further in foresight exercises on the same subject.

Finally, the question of the right intensity of research stands out as a potential obstacle to the diffusion of the new method and a litmus test of its relevance in terms of improvement of strategy-making standards globally through incorporation of high-quality foresight methods into the process. This challenge of efficiency is also addressed by FL UKnowlab design. An unpublished manual of FL UKnowlab describes the process: "In practical chronological terms the FL UKnowlab discussion moves through three phases: In the first phase you will be asked to think about predictions and hopes. Predictions are about what you think is most likely to take place (...). In the second phase we leave behind probable and desirable futures to experiment with a discontinuous framework, a new set of colours and brushes for painting an image of the future of the [given issue] (...). In the third phase the conversation moves to a comparative examination of the way anticipatory assumptions influence our understanding of the present and how specific images of the future make meaningful or visible different aspects of the present. To be clear, there is no suggestion that this model is likely to happen or is even desirable; the point is to first liberate our imaginations from the constraints of prediction and current norms by playing with paradigmatically discontinuous futures, and second, to experience more fully the power of our anticipatory assumptions in shaping not only the futures we imagine but our perceptions of the present. Finally, in the third phase the conversation moves to a comparative examination of the way anticipatory assumptions influence our understanding of the present and how specific images of the future make different aspects of the present meaningful or visible. In this last phase the challenge is to think of new questions, ones that might have been considered unimportant or incomprehensible without an effort to generate different anticipatory assumptions" (Miller 2014:3-4).

Arguably, the biggest advantages of this three-stage process are scalability and efficiency-oriented design. Since the role of an FL UKnowlab is to improve the quality of input to the subsequent FTA process by submitting the educated intuitions of participant to group scrutiny and reframing, it is worth noting that it focuses on uncovering the anticipatory assumptions rather than generating new knowledge relating to the goal of the study. In other words, FL UKnowlab not only produces new visions of the future but perhaps even more importantly focuses on challenging the assumptions, using a Socratic gadfly-method of questioning tacit

assumptions that is sound from the scholarly perspective, especially from the perspective of Horkheimer's and subsequently Habermas' understanding-oriented communicative action theory, based on questioning and not on asserting (Habermas 2010). Experimenting with the image of the future by exposing it to alternative sets of assumptions to bring out lacunas, logical faults and other inconsistencies indicating the biases and assumptions. This way, "colonization" of the decision-making field by institutional assumptions is managed and partially replaced with a communication-based negotiation of the way our images of the future influence our decision-making. Still, stock-taking of participants' views on the futures takes place as well so the non-exhaustive catalogue of events and trends can be put together at the end of the exercise.

In practice the part of the FL UKnowlabs dedicated to reframing is the one that requires the most further research and continuous, adaptations to specific subjects and implementations. The choice of a specific reframing device is decisive for limiting the number and breadth of visions to be developed during the third phase of the exercise and considered at subsequent FTA process stages. The FL UKnowlab implementations under examination in this paper used the same reframing device, an OECD model of Learning Intensive Society. This model has been used for its virtue of comprehensiveness and familiarity among the FL UKnowlab facilitators and conductors. The pragmatic benefits of this approach are evident, meaning a more efficient deployment of an FL UKnowlab without a long preparatory process. On the other hand, specific reframing models for the second stage could be generated for specific exercises. Even if the reframing device (the model) is not supposed to be a plausible or probable view of the future, it has to be: consistent, subject-specific, concise, and it has to relate to the inputs of the participants submitted in the first phase. Like some of the FL UKnowlabs have proven, using a model that is too far from the comfort zone of the audience increases the amount of effort needed to manage the discussion and facilitate the knowledge generation process. Improvement in effectiveness of such a preparatory exercise should be close to the heart of future FL UKnowlab method developers.

In addition there is a set of other relevant claims of FL UKnowlab developers that we have not examined, but still worth making note of. One of them is the network building capacity of such sessions that may prove non-negligible in the context of FTA quality standards diffusion. Building a conversation on how to use the future for strategy making may be facilitated if the standard, improved design of FL UKnowlab is diffused through UNESCO own and syndicated projects. The continuous improvement of the method, fuelled by the feedback generated from the new network may also be an important result in the long run. These claims may be realistic, given the non-proprietary character of the method and the fact that FL UKnowlabs are being conducted under the common aegis of UNESCO, presented as open improvements. However, to achieve the full benefit of networking effect and saturate the existing network with FL knowledge, creation and open publishing of FL UKnowlab learning materials and standards are required.

CONCLUSIONS

To conclude, FL UKnowlabs are emblematic of the industry-wide effort to improve the FTA toolbox, driven by expectations of the clients, by pitfall list of unimplemented foresight projects in the 28 countries of the EU and by the growing understanding that emergence, a key phenomenon of contemporary futures studies cannot be dealt with solely in the 20th Century way of contingency planning. These efforts are also fuelled by the imperative to make most of the available resources dedicated to future-oriented technology analysis, one of the transversal themes of the EU research policy (Cagnin et al., 2008). It has to be noted that FL UKnowlabs

are being developed and perfected as a method in a learning-by-doing process and after two years since the launch of the first Rockefeller Foundation grant awarded to UNESCO Foresight Section the amount of experimental knowledge of the process is still growing, allowing for tuning and improvements of the method. As has been demonstrated above, FL UKnowlab has the potential to address three important issues regarding the quality of exploratory input in the methodological development of futures studies.

It seems that FL UKnowlab is on path towards reaching maturity in terms of the number of exercises conducted and the coverage of different groups, geographical locations and strategic management cultures/styles. It has been shown that it is a promising novel method of running expert workshops to generate knowledge on the use of the future, improve the quality of inputs in FTA, provide guidelines to the number of developed visions as well as improve the comprehensibility of the whole process and its added value. Further research is needed in order to specify its role and make it a valid and established part of the strategic process. Further down the road it could be codified for better quality control and easier diffusion. This task seems a worthwhile goal to be carried out in the near future.

References

- Brodie, B. (1998), Strategy as an Art and a Science, *Naval War College Review*, Winter 1998, pp.26-38.
- Cagnin, C., and Keenan, M. (2008), Positioning Future-Oriented Technology Analysis, *Future Oriented Technology Analysis*, pp. 1 -13.
- Cagnin, C., et al. (2013), The Future of Science in Society. Report on the CGEE - UNESCO Futures Literacy Workshop.
- Gerhold, L., et al. (2014), Standards und Gütekriterien der Zukunftsforschung. Ein Handbuch für Wissenschaft und Praxis.
- Guimaraes Pereira, A., Von Schomberg, R., Funtowicz, S. (2007), Foresight Knowledge Assessment, *International Journal of Foresight and Innovation Policy*, Vol. 3, No. 1, pp. 53–75.
- Habermas, J. (2010), The Theory of Communicative Action.
- Kahn, H., and Mann, I. (1957), Ten Common Pitfalls.
- Miller, R. (2011), Futures Literacy - Embracing Complexity and Using the Future, *Ethos*, 10, pp. 23-28.
- Miller, R. (2014), imagining the future of the transition from Youth to Adult [handbook].
- Rohrbeck, R. (2010), Corporate Foresight: Towards a Maturity Model for the Future Orientation of a Firm.
- Salo, A. and Cuhls, K. (2003), Technology foresight—past and future, *Journal of Forecasting*, 22: 79–82.
- Schwarz, J. O. (2005), Pitfalls in implementing a strategic early warning system, *Foresight*, Vol. 7 Iss: 4, pp. 22 - 30.