TEXTO PARA AS QUESTÕES DE 01 E 02

O gênero **cover letter** (ou **application letter**) é amplamente utilizado no meio acadêmico, seja em processos seletivos para programas de Mestrado e Doutorado, ou em seleções internas de departamentos e instituições de pesquisa. Leia atentamente a **cover letter** a seguir e responda às questões 01 e 02.

Dear Sir/Madam,

I am writing to express my interest in applying for a research scholarship in the field of veterinary medicine at the University of California, Los Angeles (UCLA). I am currently a PhD candidate in Veterinary Medicine at UFSCar, and I believe that the opportunity to conduct research at UCLA would greatly enhance my academic and professional development.

My research focuses on animal psychology, with a particular interest in studying animal stress on beef cattle farms. UCLA's strong research programs in veterinary medicine and its access to leading experts in the field make it the ideal environment for me to further develop my skills and contribute to scientific advancements.

I am confident that my academic background, passion for research, and the support of UCLA will help me achieve my career goals and make meaningful contributions to the field of veterinary medicine. I would be grateful for the opportunity to discuss how my research aligns with UCLA's mission and how I can contribute to your ongoing projects.

Thank you for considering my application. I look forward to the possibility of joining UCLA and contributing to your distinguished research team.

Sincerely,
Sara Rodrigues
PhD Candidate in Veterinary Medicine
UFSCar

Fonte: Autoria propria.

QUESTÕES

QUESTÃO 01. De acordo com o texto, qual é o **objetivo** de Sara Rodrigues ao escrever a carta?

a) Solicitar admissão em um curso de graduação na UCLA, na área de conhecimento de Medicina Veterinária.
b) Candidatar-se a uma bolsa de pesquisa na área de medicina veterinária na UCLA.
c) Informar que concluiu sua pesquisa sobre o estresse animal em fazendas de gado na área de Medicina Veterinária no Brasil.

QUESTÃO 02. Logo na primeira linha da **cover letter**, Sara Rodrigues expressa sua motivação ao dizer "my interest in applying for a (...) scholarship". Qual das opções abaixo contém a tradução correta do verbo "apply"?

a) Inscrever-se
b) Requerer
c) Aplicar

TEXTO PARA AS QUESTÕES 03 E 04

Faculty Handbook é um manual institucional que fornece orientações e políticas para o corpo docente de uma universidade ou instituição de ensino. Ele contém informações importantes sobre direitos, deveres, benefícios, procedimentos acadêmicos, e regulamentações internas, como políticas de contratação, avaliações de desempenho e responsabilidades de ensino. Além disso, o documento orienta sobre práticas administrativas, código de conduta e critérios de promoção. É uma ferramenta essencial para garantir que os professores compreendam e sigam as diretrizes da instituição. Leia o excerto do **Faculty Handbook** da **Duke University** e responda às questões 03 e 04.

Chapter 1: The Institution

1.1 Duke as an applicant organization

The applicant or proposing organization is the entity which has established eligibility to receive and administer grants, contracts and other binding agreements from external sponsors and is accountable to the external sponsor for both the performance of the research project or activity and the appropriate expenditure of funds.

As the applicant organization, Duke University assumes responsibility for the administrative, programmatic and financial management of the research project or other activities. To meet this responsibility, University officials (department, school, center, institute, or administrative staff) perform the following functions:

- Establishing that Duke University personnel or Institutional expertise are sufficiently engaged in the project or activity and there is sufficient use of University resources in the conduct, oversight or coordination of the programmatic aspects of the proposed activities to justify the University serving as the applicant organization.
- Ensuring Authorized Organizational Representatives (AORs) are properly identified to the University research community and properly registered in submission systems.
- Confirming the University has the resources to facilitate completion of the research project or activity.
- Ensuring the budget is adequate to complete the research project or activity and funds are expended appropriately.

- Reviewing all applications seeking external funding (i.e., grants, contracts, cooperative agreements) to ensure they are true, complete and accurate submissions.
- Verifying compliance with University and sponsor policies and guidelines, which includes federal regulations when applicable.
- Ensuring individuals serving as Principal Investigators on research activities meet University and sponsor eligibility requirements.
- Developing or providing (directly or via third-party) training programs to support best practices in the execution, administration and monitoring of research activity.
- Implementing a monitoring program, encompassing the financial and programmatic aspects of grants administration, that assists University officials in identifying, monitoring and addressing potential compliance risks.
- Maintaining its standing as a responsible recipient of sponsored research funds.

If the University determines it is unable to perform its duties or serve as the applicant organization, it will withhold the submission of an application to an external sponsor or refuse an award at the time of notification.

In other instances, upon review of the terms and conditions of a research project, the University may choose not to submit the application, refuse acceptance of the award, or relinquish the award when in progress. These include, but are not limited to, scenarios in which the University determines: 1) Duke University resources, personnel or expertise are not sufficiently engaged in the conduct, oversight, or coordination of the programmatic aspects of the proposed activities; 2) the project is using resources of another organization without an appropriate agreement in place; 3) proposal was not reviewed and submitted by Duke University in advance of the award as required by the Internal Submission for External Funding Applications policy; or 4) the research project or activities are not within the mission of Duke University*.

*Applications proposing activities (e.g. clinical care, graduate medical education, quality assurance, etc.) that are within the mission of Duke University Health System (DUHS) must be coordinated with DUHS in advance of proposal submission to determine the appropriate applicant organization.

Fonte: Disponível em: https://policies.provost.duke.edu/docs/chapter-1-the-institution Acesso em setembro 2024. (texto adaptado)

QUESTÕES

QUESTÃO 03. De acordo com o texto, qual é a **responsabilidade** da Duke University como organização proponente?

a) Coordenar atividades de ensino, pesquisa e extensão para os estudantes de graduação.
b) Gerir aspectos programáticos, administrativos e financeiros de projetos de pesquisa ou outras atividades financiadas por patrocinadores externos.
c) Avaliar o desempenho dos professores em suas atividades acadêmicas de pesquisa, assegurando o acesso a bolsas, contratos e acordos de cooperação.

QUESTÃO 04. No excerto abaixo, com o uso de "*will withhold*", podemos depreender que a melhor reescrita deste excerto em língua portuguesa sem perda no sentido original é:

"If the University determines it is unable to perform its duties or serve as the applicant organization, it will withhold the submission of an application to an external sponsor or refuse an award at the time of notification".

a) A universidade reterá, pois "will" (futuro simples) denota certeza em uma ação futura.
b) A universidade deve reter a submissão, uma vez que "will" (futuro simples) indica dúvida a respeito da intenção da universidade.
c) A universidade poderá reter a submissão, uma vez que "will" (futuro simples) denota possibilidade, assim modalizando o discurso.

TEXTO PARA AS QUESTÕES DE 05 A 10

Berlin Pankow: a 15-min city for everyone? A case study combining accessibility, traffic noise, air pollution, and socio-structural data

Jan-Peter Glock and Julia Gerlach

Abstract
Cars are dominating urban traffic in cities around the world, even though daily trips in many cities are often realized with active modes of transportation or public transport. Urban transport planning processes need to adapt to this reality and the necessity of climate change mitigation. Against this background, the research project "Mobility Reporting", a joint undertaking of the district Pankow in Berlin and researchers from TU Berlin and TU Dresden, established a new, goal-driven, and participative planning process. The process identified local mobility as one of the central planning goals. The 15-min city (FMC) was thus adduced as a benchmark to analyze the district's current mobility system and development potential. We conducted extensive accessibility analyses to examine the status quo concerning the FMC. We calculated travel times to essential destinations in daily life by foot, public transport, and car. This analysis was accompanied by a mixed online and paper–pencil survey conducted to evaluate the perceived accessibility of people in Pankow. The survey results shed light on the question of which walking time thresholds constitute a "very good" or "good" accessibility. Further analyses included environmental and social variables, allowing us to check whether areas with different accessibility levels also differ regarding the socio-economic characteristics of their inhabitants. For example, do socially advantaged neighborhoods have better local accessibility? Is there a trade-of between exposure to environmental pollution and good accessibility? With this contribution, we shed light on what an FMC is and ought to be. Results from the survey support the normative and political vision of the FMC. Pankow generally offers the merits of a walkable city, showing the expected travel time differences between the dense inner city and the outskirts. Socially disadvantaged neighborhoods are not consistently less accessible. However, there seems to be a trade-of between good accessibility (especially PT accessibility) and correlated externalities of transport, namely air pollution and noise.

Keywords: 15-min city, Compact city, Accessibility, Mobility, Social disadvantage, Environmental pollution, Traffic noise, Air pollution, Perceived accessibility.

1 Introduction

Cars are dominating urban traffic in cities around the world. With cities continuing to grow, traffic continues to be a problem both on the local and global scale. In response to excessive traffic noise, air pollution, greenhouse gas emissions, and the loss of the human scale, effective strategies to create sustainable cities and urban transportation systems are needed. In this context, the urban planning paradigm of the compact city has revived in a new shape: the 15-min city (FMC). Despite the need for a congruent definition of the FMC, its basic principle is simple: everyone should be able to reach facilities catering to basic needs within 15 min.

1.1 The FMC as a critical strategy for sustainable urban development

The paradigm of "The Compact City" has been one of the key strategies for urban planners to enable sustainable urban development since the 1990s. Its focus is "a relatively high-density, mixed-use city, based on an efficient public transport system and dimensions that encourage walking and cycling". By increasing urban housing density and reducing greenfield development, the paradigm intends to limit urban sprawl, decrease per capita rates of energy use, and reduce the use of construction materials. Investments in public transport (PT) as well as walking and cycling are heavily advocated in order to reduce car dependency. In 2020, the FMC as the descendant of the compact city had become the center of attention when Paris declared the concept developed by Carlos Moreno to be its new urban planning approach. The FMC aims to enable all residents to reach essential destinations in day-to-day life within a short walk or bicycle ride from home. Consequently, within the framework of the FMC, accessibility depends on proximity and slow modes even more than is proposed in the "Compact City" paradigm (Pozoukidou & Chatziyiannaki, 2015). As described in Chau et al., Logan et al., and Allam et al., recent FMC strategies refer to a notably broad set of societal goals—besides the reduction of GHG emissions and resource use, the notion of an FMC has been connected to an increased local environmental quality, positive impacts on social cohesion and equity, and thus, in general, an increased quality of urban life for everyone. However, further research must fortify (or challenge) those claims.

2 Research questions

This research aimed to explore the status quo of mobility and transport-based accessibility in the district of Pankow in Berlin. The foundation of this research is the ongoing project Mobility Reporting. This joint undertaking of the department for urban development of Pankow and researchers from TU Berlin and TU Dresden established a new, goal-driven and participative planning process between 2017 and 2020 while emphasizing the need to plan for an FMC. We conducted an extensive analysis of the local accessibility levels in the district to evaluate compliance with the planning goals of an FMC. In addition, equity implications of the distribution of accessibility and environmental quality were studied to support the formulation of suitable strategies guiding future transport planning processes. The project addresses a number of the research challenges mentioned above while relating to social inclusion and the individual perceptions of inhabitants regarding a satisfactory accessibility level and environmental effects of the FMC. It gives specifical answers to the following research questions (RQs):

i. Is Berlin Pankow already an FMC?
ii. Is Pankow an FMC for everyone, including the elderly and people living in socially disadvantaged neighborhoods?

iii. Is the goal of an FMC supported by the Pankow inhabitants' subjective accessibility expectations?
iv. Is there a trade-off between the FMC and exposure to traffic-related environmental pollution, specifically air and noise pollution?

4. Method

4.1 General methodology

The research presented in this article was part of an applied scientific project in cooperation with the district administration. It aimed to establish a new mobility planning process that systematically puts people and the environment at the center of decision-making. This planning process is based on data picturing the demands of different societal groups, subjective perceptions of the transport system and mobility options, traffic-related noise, and air pollution in addition to traditional transport data such as traffic volumes. We used data from a GIS-based accessibility analysis, a mobility and accessibility survey, and an analysis of the external effects of transport, accompanied by data about the social structure of neighborhoods to gain insights about the status quo in Pankow and answer our research questions. Before the statistical data analysis, we split Pankow into three subareas to account for its spatial structure and population density heterogeneity. The three subareas defined are the inner city, the outer city, and the suburban area.

4.2 Mobility and accessibility survey

We conducted a mixed online and paper-pencil questionnaire survey in Pankow. The survey was used to capture the perceived importance and the perceived travel times to a variety of destinations, as well as the respondents' satisfaction with those travel times. It also included questions concerning the respondents' neighborhood walkability and mobility behavior. Seven hundred one residents completed the comprehensive questionnaire, thereof 53 percent female. This research on the FMC specifically draws on several survey questions addressing local accessibility. Firstly, respondents were asked to estimate their travel times while walking to different destinations. These perceived travel times were used as an indicator of subjective accessibility. Secondly, respondents could rate their satisfaction with said travel times on a school-grade rating scale. We matched the survey data with GIS-based accessibility data at the address level in order to compare perceived to GIS-based walking times and respondents' satisfaction with those accessibility levels. This allowed us to gain a deeper insight into the subjective perception of "good accessibility" in comparison to the normative stance of an FMC.

5 Results

5.1 Is Pankow already an FMC?

Average travel times in Pankow show a spatial and modal divide. Our analysis of neighborhood accessibility showed that while almost every resident of the inner city (92%) and still 76% of the residents of the outer city can reach all basic services analyzed within 15 min of walking, this is only valid for 29% of the suburban population.

Table 7 shows a more detailed picture of the neighborhood accessibility within the inner city, outer city, and suburban area of Pankow. Within the inner city, inhabitants most likely have longer walking times to public parks, followed by primary schools, general practitioners, and pharmacies. However, those deficits do not accumulate spatially; neighborhoods without, e.g. a public park close by still provide excellent local accessibility to the other analyzed destinations. In the same way, neighborhood accessibility in the outer city remains high, albeit

fewer neighborhoods reach the “strict” FCM goal of at most 15 min of walking to all essential destinations in daily life. However, over 90% of the population of the outer city lives in neighborhoods with at most one destination type not easily reachable by walking. As in the inner city, local accessibility is highest for kindergartens, playgrounds, and supermarkets. The main difference lies in the local accessibility of primary schools, which is significantly lower than in inner-city neighborhoods. Suburban neighborhoods differ significantly from the other subareas regarding neighborhood accessibility. For example, even though kindergartens, playgrounds, and supermarkets remain the destinations to be most likely available nearby, these destinations are not within walking distance for as much as 20 to 25 percent of the suburban population. Other destinations are even less accessible by walking—e.g., only around 50% of all inhabitants can reach the nearest primary school in 15 min of walking.

Discussion

With this contribution, we shed light on the relationship between the FMC as a normative political vision and a developed transport system in a large Central European city. The research approached the FMC through a mobility and accessibility survey, a GIS-based accessibility analysis, and a GIS-based analysis of air and noise pollution. To a great extent, Pankow already offers the merits of an FMC, if not a walkable city (RQ 1). At the same time, it shows the expected differences between the inner city and the outskirts. We expect that these differences are strong enough to impact mobility behavior. However, this claim would need to be confirmed in future research. The same holds true for the comparatively small travel time differences between socially disadvantaged housing blocks and non-disadvantaged housing blocks, as well as different age groups (RQ 2). The congruency between subjective and objective travel times indicates that objective accessibility can be a good approximation of subjective accessibility as the underlying driver of behavior (RQ 3).

Larger-scale, GIS-based analyses may support city administrations and transport planners to spatially prioritize their activities aiming at the development of an FMC. Within prioritized areas, additional information on subjectively perceived accessibility could improve planning processes aimed at the FMC. Such information could e.g. be gathered in planning workshops, with qualitative interviews or other participatory planning methods. Regarding neighborhood accessibility (walking), results from the survey show that the vision of the FMC aims at a minimum level of accessibility which would be considered to be “good” or at least “satisfactory” by most people. This sheds some further light on the discussion on suitable travel time thresholds for an urban transport system focused on active and sustainable transport modes and high quality of life.

To summarize, depending on how travel time reduction—as the heart of the FMC paradigm—is accompanied by additional goals, such as reducing global and local environmental effects of traffic and social equity, Pankow is an FMC for most of its residents. This is particularly true for residents of the inner-city areas, even in socially disadvantaged areas that are relatively less accessible. However, shorter travel times with motorized modes of transport come with increased exposure to noise and air pollution.

Fonte: GLOCK, J. P., GERLACH, J. Berlin Pankow: a 15-min city for everyone? A case study combining accessibility, traffic noise, air pollution, and socio-structural data. *Eur. Transp. Res. Rev.* **15**, 7 (2023). https://doi.org/10.1186/s12544-023-00577-2. Disponível em: https://etrr.springeropen.com/articles/10.1186/s12544-023-00577-2#Tab7 Acesso em outubro, 2024. (texto adaptado)

QUESTÕES

QUESTÃO 05. Com base na leitura do resumo deste artigo, escolha a alternativa que apresenta o **objetivo principal** do projeto de pesquisa "*Mobility Reporting*" conduzido no distrito de Pankow, em Berlim.

a) Examinar os impactos econômicos do uso de carros no transporte urbano.
b) Analisar a mobilidade local com base no conceito de cidade de 15 minutos (FMC).
c) Propor políticas de transporte baseadas na percepção dos moradores de cidades pequenas.

QUESTÃO 06. Com base na leitura do texto, pode-se definir o **conceito de FMC** como:

a) Um modelo de cidade onde todos podem acessar serviços essenciais dentro de 15 minutos a pé ou de bicicleta.
b) Uma estratégia urbana focada exclusivamente em reduzir emissões de gases de efeito estufa, com a retirada de meios de transporte individuais de circulação.
c) Um planejamento urbano que promove a expansão territorial e maior uso de transporte individual como estratégia de redução de gases na atmosfera.

QUESTÃO 07. Nesta investigação, os pesquisadores exploraram **quatro perguntas de pesquisa** (RQs) relacionadas ao distrito de Pankow e ao conceito de cidade de 15 minutos (FMC). Qual alternativa representa a relação entre as RQs e os desafios de planejamento urbano estudados?

a) As RQs abordam a distribuição de acessibilidade em áreas socialmente vulneráveis e a percepção dos moradores sobre transporte público eficiente, utilizando-se de uma coleta de dados extensiva.
b) As RQs investigam se o conceito de FMC também é aplicável a áreas densamente povoadas por generalização e se as metas de acessibilidade são consistentes com a legislação ambiental local.
c) As RQs relacionam-se a avaliar se Pankow já cumpre os critérios de FMC, a inclusão social, as percepções subjetivas dos moradores sobre acessibilidade e os impactos ambientais relacionados ao transporte.

QUESTÃO 08. Com base na **metodologia** descrita, quais métodos foram utilizados para avaliar a percepção subjetiva de acessibilidade no distrito de Pankow?

a) Os pesquisadores aplicaram uma análise mista GIS quantitativa para determinar as diferenças de acessibilidade entre regiões urbanas e suburbanas, bem como a acessibilidade local nas 3 diferentes regiões da cidade (centro, periferia e subúrbio).
b) Os pesquisadores aplicaram um questionário misto (online e impresso) que coletou percepções de 701 moradores sobre tempos de viagem, satisfação com a acessibilidade e características da mobilidade em seus bairros.
c) A análise baseou-se na coleta de dados de tráfego tradicional e observação direta do comportamento de mobilidade dos moradores nas três subáreas de Pankow, com relação ao tempo estimado de caminhada até determinados lugares na cidade.

QUESTÃO 09. "*Um grupo nominal é uma estrutura linguística que consiste em uma palavra ou conjunto de palavras que funcionam juntas como um único elemento dentro de uma sentença. Geralmente, um grupo nominal inclui um núcleo, juntamente com modificadores e outros elementos que o acompanham para fornecer mais detalhes ou contexto.*"

Texto redigido pela equipe de elaboração de exames do Instituto de Línguas (novembro, 2024).

Considerando o processo de leitura de grupos nominais, observe abaixo os excertos retirados da última seção do texto e escolha a alternativa que apresenta as traduções corretas:

I. '**global and local environmental effects of traffic and social equity**' – 'efeitos ambientais globais e locais do tráfico e da sociedade igualitária'.
II. '**particularly true for residents of the inner-city areas'** – 'particularmente verdadeiro para os residentes das áreas centrais da cidade'.
III. '**shorter travel times with motorized modes of transport'** – 'tempos de viagem mais curtos com modos de transporte motorizados'.
IV. '**increased exposure to noise and air pollution'** – 'maior exposição ao ruído e à poluição do ar'.

a) II, III e IV estão corretas.
b) Somente II está correta.
c) Somente I e IV estão corretas.

QUESTÃO 10. Com base na Tabela 7 extraída do texto, com dados detalhados sobre acessibilidade nas diferentes regiões, leia as assertivas e responda:

Table 7 Share of population with 15 min walking time by sub-area and destination

Destination	Share of population with at most 15 min. walking time (%)			
	Inner city	Outer city	Suburban areas	District
Kindergarten	100	98	76	95
Primary school	97	83	52	85
Playground	100	99	80	96
Public park	96	92	67	89
General practi-tioner	98	96	69	92
Pharmacy	99	94	67	91
Grocery store	100	98	77	95
No. of inhabitants	228,438	93,377	84,310	406,125

I. Na região central da cidade, a população tem tempos de caminhada mais longos até parques públicos, seguidos por escolas primárias, consultórios médicos e farmácias.
II. A acessibilidade nos bairros da periferia da cidade é relativamente alta, comparada à acessibilidade da região central
III. Nos bairros periféricos, a acessibilidade local é maior para creches, playgrounds e supermercados.
IV. As áreas suburbanas diferem significativamente das outras subáreas em relação à acessibilidade local. Embora creches, playgrounds e supermercados continuem sendo os destinos mais prováveis de estarem mais próximos, esses locais não estão a uma distância a pé, dentro dos padrões da FMC, para cerca de 20 a 25% da população suburbana.
V. No subúrbio, aproximadamente 50% dos habitantes conseguem chegar à escola primária mais próxima em 15 minutos de caminhada.

É correto o que se afirma em:

a) I, II e IV
b) III, IV e V
c) Todas as assertivas estão corretas.

TEXTO PARA A QUESTÃO 11

Aquicultura é a prática de cultivar organismos aquáticos, como peixes, moluscos, crustáceos e plantas aquáticas, em ambientes controlados. Essa atividade é realizada em águas doces ou salgadas e pode ocorrer em tanques, viveiros, estufas ou em sistemas de recirculação, que minimizam o impacto ambiental e otimizam a produção. É uma das formas mais rápidas de produção de alimentos, sendo uma alternativa importante à pesca tradicional, especialmente à medida que a demanda por frutos do mar aumenta globalmente. Leia o texto abaixo e responda a questão 11.

The future of fish farming is on land

New systems cut pollution and allow fish to be raised anywhere in the world

THE RUGGED, chilly coast of northern Norway, beyond the Arctic Circle, is not usually thought of as prime agricultural land. But far down a dead-end road on the shores of Skjerstad Fjord sits Salten Smolt, one of the most advanced farms in the world. Rather than crops or cows, though, the firm produces fish. Inside its 7,000 square meter main building are tanks capable of producing 8m smolt—juvenile Atlantic salmon—every year.

Fish farming is the fastest-growing form of food production in the world. Seafood accounts for around 17% of the world's protein intake (in some parts of Asia and Africa, the number is nearer 50%). The OECD, a rich-country club, reckons that, thanks to population growth and rising incomes, global consumption of fish will reach 180m tonnes by the end of the decade, up from 158m tonnes in 2020. But the ocean has only so much to give. The World Bank reckons that 90% of the world's fisheries are being fished either at or over their capacity. Aquaculture has therefore accounted for nearly all the growth in fish consumption since 1990. It will have to account for almost all the growth to come, too.

As with farming on land though, aquaculture can cause environmental damage. Many farmed fish are grown in net pens, either in rivers or the open ocean. Uneaten food and fish waste can pollute the surrounding waters. When net pens break, escaped farmed fish can damage the local ecosystem. Inland "flow-through" farms require continuous streams of freshwater from rivers or wells, competing with those who might wish to drink it instead. Rearing lots of fish in close proximity risks outbreaks of diseases and parasites, which sweep in from the open water. That requires antibiotics and other drugs to keep the fish healthy.

It is these sorts of problems that newer fish farms, like Salten Smolt, hope to solve. It makes use of a technology called "recirculating aquaculture systems", or RAS for short (pronounced "Rass"). Rather than relying on a constant flow of natural water to keep fish healthy, a RAS system grows fish on land in tanks whose water is continuously cleaned and recycled. That offers three big advantages. Compared with standard aquaculture systems, RAS farms use far less water, can take better care of their fish, and can allow picky species to be raised anywhere in the world.

RAS farms are, in essence, much bigger versions of home aquariums. Each consists of a tank in which the fish swim, and a set of water-cleaning components to dispose of the waste that they produce. Much of the technology is recycled from the sewage-treatment industry.

Reduce, re-use and recycle

Unwanted solids—fish faeces and uneaten feed, mostly—are removed first. This is done mechanically, using a conical tank, gravity and a series of increasingly fine mesh filters. Most of the remaining waste is ammonia. Fish secrete the stuff through their gills, as a byproduct of their metabolisms, and too much is toxic. The ammonia-laden water is therefore pumped through colonies of bacteria which, given enough oxygen, will convert the ammonia into nitrite and nitrate. Further steps can remove other contaminants such as phosphorus and heavy metals.

The cleaner the water, the more can be recirculated, and the less is needed from outside. A completely closed loop is impractical, at least for now. But state-of-the-art systems, such as Salten Smolt's, can reduce water usage by more than 99%. Standard salmon-farming consumes about 50,000 liters of water for each kilogram of salmon produced. A RAS system might need just 150. The upshot, says Steve Sutton, the founder of TransparentSea, a RAS shrimp farm near Los Angeles, is that RAS farms "leave the wild environment alone so that [farmed fish] don't spread pathogens or pollute the waterways".

Concentrating the waste in one place offers advantages of its own. One of the biggest missed opportunities with standard aquaculture, says Kari Attramadal, head of research at Nofitech, another Norwegian aquaculture firm, is that the waste released into the environment from standard fish farms contains plenty of valuable nutrients. Nitrates can be used as food for hydroponically grown crops. John Sällebrant, Salten Smolt's production manager, says that the firm recovers and dries fish faeces, as well as uneaten feed, for conversion into agricultural fertilizer.

Keeping fish alive in artificial tanks relies on keeping tight control of the entire system. Errors can be costly. If the oxygenation system fails, says Dr Attramadal, fish can start to die within eight minutes. But that need for careful monitoring also offers the ability to fine-tune the environment in which the fish are being raised. That allows RAS systems to perform an aquatic version of what, on land, is called precision agriculture.

Salmon, for instance, prefer cold water. A climate-controlled tank is able to provide the ideal temperature at all times, without worrying about currents, tides or weather, boosting the speed with which the fish grow. ReelData, a startup based in Nova Scotia, uses data from cameras and

sensors in RAS tanks to estimate how hungry fish are, how much they weigh and even to assess how stressed they are. The firm says its technology can raise a farm's productivity by up to 20%.

And because they do not rely on the natural environment, RAS systems can, in principle, be built anywhere. Atlantic Sapphire, another Norwegian firm, has built an Atlantic salmon farm near Miami, a thousand miles south of the fish's natural range. Being close to big cities reduces the distance that fish have to travel before arriving on a dinner plate. Pure Salmon Technology, a Norwegian RAS provider, is building a farm in Japan. It reckons that lower transport costs will more than halve the carbon footprint of each kilogram of salmon, despite the extra energy costs involved in running a RAS system.

As with any new technology, there have been teething troubles. Half a million fish, or about 5% of the total, died at Atlantic Sapphire's plant in Florida in 2021, for instance, after problems with its filtration systems. (The firm describes the incident as a piece of "expensive learning" to be "seen in the context of RAS having been in the early stages of its rapid development".)

Small fry

The biggest downside is cost. All those pipes, pumps and monitoring systems mean that capital costs are significantly higher for RAS farms than for standard ones. (That is one reason why many existing systems focus on salmon, a comparatively pricey fish.) Even in Norway, where about half the country's salmon farms use RAS, it is limited to the first stage of the fish's life. Juvenile fish are still grown into adults in standard open-water pens.

Tax changes in Norway may change that, says Matt Craze of Spheric Research, a firm of aquaculture market analysts. And there are other ways to keep costs down. Some firms are experimenting with hybrid systems. These dispense with the more expensive bits of waste-management kit, but can still cut overall water usage significantly. Economies of scale will help, too. Mr. Craze reckons that, while smaller RAS farms might produce fish at twice the price of standard aquaculture, bigger ones should, if they can iron out the gremlins, eventually be able to match them.

For now, though, RAS remains a tiddler. Kathrin Steinberg, head of research at the Aquaculture Stewardship Council, a Dutch non-profit organization, says that less than 5% of the farms certified by her organization make use of it. But with the world's demand for fish rising inexorably, that share, she says, is growing.

Fonte: Disponível em: https://www.economist.com/science-and-technology/2023/05/31/the-future-of-fish-farming-is-on-land?utm_medium=cpc.adword.pd&utm_source=google&ppccampaignID=19495686130&ppcadID=&utm_campaign=a.22brand_pmax&utm_content=conversion.direct-response.anonymous&gad_source=1&gclid=CjoKCQjwsc24BhDPARIsAFXqAB3kyrxrxhQfdbICksLQz8iCjmZNeZSKeeRnCs9ntE2PjIHsMj8vCTcaAp04EALw_wcB&gclsrc=aw.ds Acesso em: setembro 2024.

QUESTÃO 11. Em até 20 linhas, redija um **resumo informativo** do artigo de divulgação científica ***The future of fish farming is on land*** publicado no site da revista **The Economist**. Seu texto deverá conter as informações essenciais e termos-chave do artigo, dados estatísticos relevantes e apresentação das fontes-base mencionadas para a redação da publicação original. O caráter informativo deve ser mantido. Lembre-se de que seu texto deve ser redigido em língua portuguesa no caderno de respostas, à caneta azul ou preta. Não faça tradução direta ou literal do artigo.