

Employing Systems Thinking Approaches and the Service Design paradigm as tools to support collaboration across a multi-stakeholder initiative: the responsible food consumption exemplar

Working Paper

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Abstract

The main theme of this paper is the design engagement with large complex problem spaces such as food security. In that context, an approach based on Systems Thinking is introduced that utilises the

service design paradigm to support multidisciplinary research within a collaborative project. The use of Systems Thinking enables the capturing, understanding and learning about such global challenges. It is expedient to show how such approaches reach parts of the project such as a subproject, but without applying reductionism and as a result losing the potential to consider the design problem space as a Holon. The use of the paradigm of service design, with its still emergent theories and methods, is a convenient vehicle to structure design interventions, at the subproject level.

Introduction

Food security is an acknowledged Grand Challenge of contemporary society. Many researchers have proposed to make use of Systems Thinking to help understand the systemic nature of the problem space (Bosch et al, 2007). This paper presents the use of Systems Thinking in order to be able to capture and understand the parts of the Holon without depriving those parts of their acknowledged roles within the Holon, nor of taking from them, their knowledge of being part of the Holon. That is, while focusing in on one aspect of the Grand Challenge, for instance the role of responsible food consumption, researchers are, at the same time, enabled to firmly embed that aspect within the bigger picture, and appreciate the complex interdependencies that exist between that aspect and the bigger picture. In this case, consumers are not consumers of any product or service, but consumers of food, where food is a commodity that is at the centre of this particular challenge of food security. What constitutes responsible behaviour in food consumption also inherits the project researchers' personal and professional understandings.

The paper also draws upon the paradigm of service design to help shape deliberations towards designed interventions. A notable feature of service design is that it abstracts away from products, although it may help suggest and even define the products which will be necessary to set up a service, to deliver it and to 'consume' it. In addition, those working in service design often speak to their efforts in large complex issues. They have been included in think tanks and policy laboratories, looking to bring their skills to the shaping of public policy, (Kimbell, D) and even helping shape new societal structures and relationships, such as those found in fair trade, social innovation, and sustainability (Dorst & Kaldor, 2016; Jegou & Manzini, 2008; Manzini 2009, 2014; Meroni & Sangiorgi, 2011).

Thus the themes presented in this paper revolve around the opportunities for collaboration across large multi-disciplinary projects, as well as the within parts of those projects, and what Systems Thinking and the service design paradigm working together can bring. The paper will discuss the issues involved in terms of rationale, and of outcomes to date, and present some reflections from both the exercise as well as the feedback received from attendees of RSD6¹.

Background

This paper is set in the context of a wide-ranging inter-disciplinary project called IKNOWFOOD² standing for "Integrating knowledge for food systems resilience". The project involves experts from

¹ Relating Systems Thinking to Design Symposium (RSD6) 2017 <https://systemic-design.net/rsd6/>

² www.IKNOWFOOD.org part of the Global Food Security's 'Resilience of the UK Food System Programme'

many disciplines including computer science, human-computer interaction (HCI), management, politics, environmental studies, economics, psychology and epidemiology. It also includes representatives of stakeholders from the various stages in the food supply chain such as food producers (e.g. farmers), distributors (e.g. retailers and supermarkets), and consumers. The overarching aim of the project is to leverage the work of various stakeholder groups involved in food production and distribution as well as consumption to develop better understandings of sustainability. In particular, the project seeks to better understand the concept of resilience in food chains against the background of Food Security, a complex problem of global proportions (Committee on World Security, 2015; FAO, 2003, 2009; FAO et al, 2017; Development Initiatives, 2017; Global Nutrition Report, 2017; SOFI 2017), and named both as part of the United Nations Millennium Development Goals³ and subsequently as the Sustainable Development Goals⁴.

As is normal practice, the project work is divided into subprojects or 'themes'. In this case, the division is according to the stakeholders or actors in the food chain. IKNOWFOOD distinguishes 3 such groups of stakeholders: the producers, the distributors and the consumers. The authors' formal involvement is in the theme where the role(s) of consumers is the focus.

Within the consumer theme, there are several groups of researchers coming from differing disciplines, engaged on pursuing research into various aspects of the consumer theme. One is working from the discipline of social psychology to understand, amongst other things, motivations for food choices; one is working from the health sciences perspective to better understand how to promote healthier habits with regard to food consumption. A further group, coming from Human Computer Interaction (HCI) is looking to understand how to design sociotechnical systems to support consumers in responsible food consumption behaviours.

Consistent with usual practice, the IKNOWFOOD project dedicates a subproject (theme) to bring together the results from work on the different themes, conceptualized as parts of the food chain (production; supply chains and consumers). This is the 4th theme in the project, (theme 'network').

However, in any large project, work on such complex issues creates a challenge to avoid reductionism. In this case, each group working in their own silos, and attempting at a later date an integration of their findings. Avoiding reductionism is important in order to retain the emerging links between the different parts of the problem space. Thus, within the context of the project, the initial roles of the authors were twofold: a) they were associated to the HCI group of researchers whose initial brief was to understand aspects of, and eventually design and develop, technological interventions to support responsible consumer behaviour and sustainable practices with regard to food; b) as Systemic Design researchers, working in Service Design, they were interested to investigate how to support this consumer subproject team, by considering that work as an emergent facet of the whole problem space.

³ <https://www.un.org/millenniumgoals/bkgd.shtml> and <http://www.mdgmonitor.org/mdg-1-eradicate-poverty-hunger>

⁴ <https://sustainabledevelopment.un.org/post2015/transformingourworld> and <http://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-2-zero-hunger.html>

These roles can be broadly understood as applying Systems Thinking to support design interventions in challenging situations that are characterised as being highly complex and human-centric. Such situations are increasingly acknowledged as major design problem spaces requiring the participation of multiple stakeholders and use of inter-disciplinary thinking tools. This acknowledgement aligns the overall approach of the project. IKNOWFOOD aims to develop a deeper understanding by researchers from many disciplines of issues present throughout the food supply chain (“from farm to plate”) in order to inform policy and to design innovative services for farmers, retailers and consumers to improve resilience in the supply chain.

Systems Thinking enhanced by Service Design applied to complex challenges

In design, and in most human-centric domains, the complexity of the problem spaces to be tackled is acknowledged very early in the positing of the thesis that also states the intended ways of dealing with the problem. Sometimes, but not frequently, complexity is distinguished from complication (Darzentas & Darzentas, 2014; Sargut & McGrath, 2011;). The necessity to consider the ‘whole problem’ as a system, or to use Systems Thinking is frequently part of the discourse.

The need to take into account, as much as possible, the whole problem has been in evidence in management literature for some time (Checkland 1981, Flood & Jackson 1999, Jackson, 2003). In the literature on design, it is a relative newcomer. Outside of the work from the Relating Systems to Design (RSD) community, (Sevaldson 2011, 2017) design researchers have drawn attention to Systems Thinking, (Valtonen, 2010); have noted the paradigm of ‘Whole Systems Design’ (Charnley, Lemon & Evans, 2011, Blizzard & Klotz, 2012), have recognised the need to understand and include as much of the context as possible (Norman, 2009), have posited systems thinking as an essential part of Design, where designing is an intentional human activity, distinct from other traditions (Nelson & Stolterman, 2012). This has also been evident somewhat in Service Design praxis (Lee, 2011) where service designers were described as moving towards tackling ‘wicked problems’, and as well moving from tackling problems within systems to influencing the behaviour of whole systems, such as healthcare systems (Jones, 2014).

Service design often rests on activities that require stakeholders coming together in collaboration to learn about each other’s ways of working and each other’s aims and goals. While this may result in smoother interaction and co-produced value between those parties, it may not account adequately for those others who are not directly involved. Using Systems Thinking and actively creating a shared understanding of the wider problem space, allows for wider/deeper or ‘systemic’ interventions to bring about longer lasting results.

Various terms used to describe the ‘whole’, such as ‘the system’ and the ‘Holon’ and this can be confusing. The main thesis here is that capturing the Holon of a design problem space is a necessary step in order to ‘enter’ the world of Systems Thinking. ‘Holon’ as defined by Koestler (1967) does imply systemic nature. In our work we adopt the meaning of the Greek word ‘ὅλον’ which means ‘whole’ or ‘everything’ in a metaphysical sense, in relation to the problem space. This has been stated by Checkland (1981) who although he used the term ‘rich picture’ to describe a co-created visualisation of the whole of the problem space, recognised the potential usefulness of the term ‘Holon’ (Checkland 1988).

It is important to note that a rich picture or Holon is not a systemic description. It is a starting description of the system, and that a 'translation' of that rich picture or Holon into a system needs to be carried out. The translation is achieved with the aid of the 'thinking' of Systems Thinking. The Holon does require capturing, learning, and understanding the design problem space, and Systems Thinking offers concepts and tenets to support that translation process. In the figures below, the complex challenge of food security is used to illustrate the translation process where Figure 1 represents a Holon and Figure 2 a refinement of that Holon into an initial systemic representation.

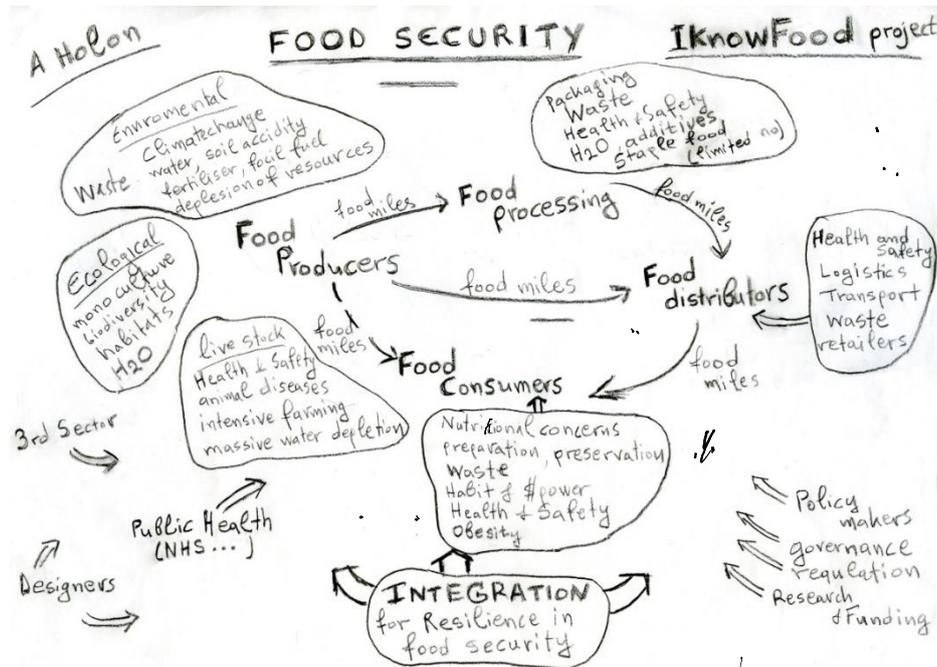


Figure 1. A Food Security Holon

Figure 1 above shows an initial version of such a Holon, something many Systems Thinkers still refer to as a 'rich picture', although the term has been 'hi-jacked' and used in a general sense outside of Systems Thinking and of Checkland's Soft Systems Methodology (Checkland 1981). This Holon is not a systemic view of the problem of food security. It consists of stakeholders' issues and components and links considered relevant. For structuring such a Holon a designer could use methods and approaches from the world of design such as those informed by ethnographic as well as participatory activities.

In order to translate and transform the Holon into a representation of a system, it is necessary to try to identify properties of systems, such as the boundaries, the inputs and outputs, the elements/subsystems and their interrelationships and the functions or behaviours of the system. Translating Holons into systems in Systems Thinking by default requires many iterations to generate, utilise and learn from new understandings of the problem space. Systems thinkers have remarked that the most obvious parts of systems are their elements, so these are often described first; that the interrelationships are often felt and perhaps not well articulated, while the behaviours can be far from what was planned, publicly announced or what was expected.

Systems Thinking also offers a number of tenets and concepts that can be used to study, learn about and understand systems. These tenets and concepts firstly help designers to translate from the

Holon, for instance by showing that there are interrelationships that are missing. Further, these tenets and concepts could help guide the formulation of the design interventions. These interventions would seek both to improve the situation, as well as to avoid making things worse. Systems Thinking helps make explicit the unexpected consequences: making an improvement that has repercussions throughout the system that (eventually) negates any benefit from the improvement. These tenets and concepts may guide the interventions by helping to find things like leverage points, where small changes can be made that have the maximum impact; and bright spots, where there is a dynamic supporting positive change within the system.

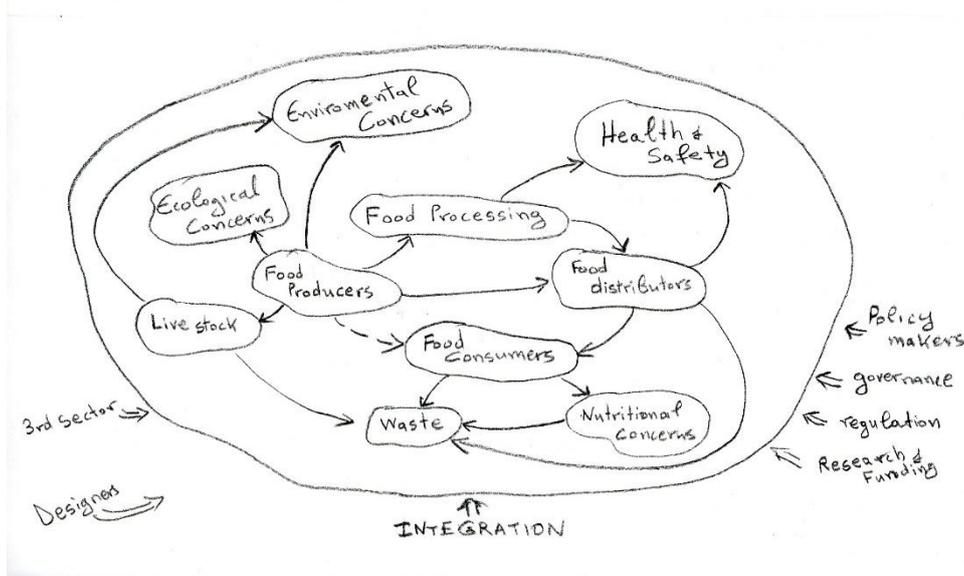


Figure 2. Food Security System

Figure 2 above shows also a limited initial version of the translation of the Holon to a Systemic view of the problem space with identified subsystems and their links.

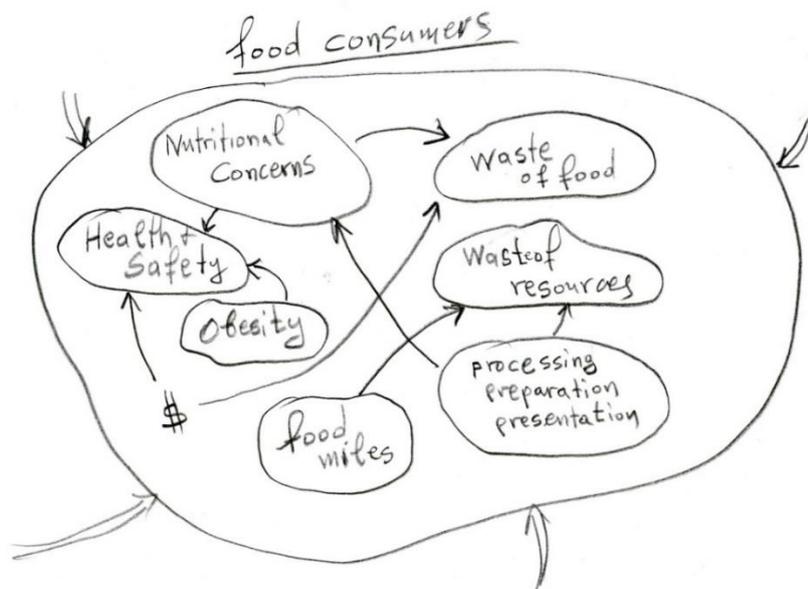


Figure 3. Food Consumers

Figure 3. shows the subsystem of the consumers with their links to important emerging issues and identified components. It is at this stage of the Systems Thinking based approach to the complex problem space of food security that the thinking about design interventions becomes apparent. In the case of the consumers the above subsystem shows a way to proceed by learning about their emerging concerns.

As the approach moves forward it becomes clearer that a way to structure the answers to the questions about what is needed, can be viewed through the perspective of designing services. For instance, services might be built around supporting the need for awareness about a number of identified issues in the food consumption behaviour such as ‘food miles’⁵, or balancing competing ‘agendas’ in the minds of consumers, for instance combining inertia, lack of time, and easily available convenience food, and contrasting it with more ‘responsible’ behaviours, such as consuming only nutritional food produced by sustainable practices.

In other words, to meet those concerns in the context of such a complex problem like food security,, is to beginning thinking in terms of designing relevant services identified through the systems thinking approach. Service design connecting communities and people comes first in such complex issues and it is difficult to imagine designing relevant products before services. That realisation shows the importance of service design in designing for complex systems. It also supports the statement that for instance any products that are designed using this process, are in fact, by-products of service design, (Darzentas and Darzentas , 2016), since first the service is designed, and later the different products used to deliver the service can be designed.

The Responsible Food Consumption Exemplar

In this section, we detail some of the aspects of the consumer behavior that have emerged so far, before going on to reflect what this exercise of using systems thinking and service design approaches offers to notions of supporting collaboration across a multi-disciplinary project.

Responsible Food Consumption behaviours

As previously noted, the authors are working with the HCI researchers. They have begun by setting an agenda around responsible food consumption behaviours. While there are many suggestions available for responsible behaviours, and many motivations, (health, cost, sustainability) many consumers are unable or unwilling to adhere to them. A main reason for this is that there are many divergent and complex issues in promoting responsible food consumption. Very often these issues are conflicting. The lack of clear information leaves consumers asking themselves whether they should purchase goods from remote regions of the world, in order to support farmers in less-resourced countries; or whether it is more responsible to purchase from local farmers, and also save on food miles? Another practical issue concerns how consumers can access information about sustainability at the point of purchase and how consumer information can be supplied that is both trustworthy and sensitive to particular cultures and dietary regimes.

In the home they are investigating methods to support the reduction of food waste. It is already well documented that much food purchased is subsequently thrown away. One estimate is that as much

⁵ Food miles: a mile over which a food item is transported during the journey from producer to consumer, as an approximate unit of measurement of the fuel used to transport it.

as 1/3 of food produced is wasted⁶. There are a variety of reasons for this, including: the food is past its 'use-by-date' (although sometimes the food is still edible); consumers do not know how to store food, or how long it is safe to keep it; consumers do not know how to prepare it. Thus one feature that consumers have asked for, is a means to notify them what food they have that is approaching its 'use-by-date': that way food would not get overlooked in the fridge or cupboard and subsequently be thrown out. Another feature is to suggest menus based on food that is coming up to the 'use-by-date' to encourage consumers to make use of food that they already have. Work by a large supermarket chain in the UK⁷ with a commitment to reducing food waste, found that many people are not knowledgeable about food preparation. Another group of social entrepreneurs, working to find ways to deal with food poverty⁸, notes that many people have very basic cooking equipment, as well as difficulties in storing fresh food.

All these issues require understandings and integration of many bodies of knowledge, from knowledge about food production, distribution (including processing and packaging, marketing and retailing) as well as issues more specific to consumption, such as consumer behaviour, knowledge about food safety and local customs. Many of these issues are being investigated by different disciplines each with their own sets of tools. Many researchers are collecting and analyzing data to feed these understandings, at the same time well aware that the issues are very complex and interdependent. Integrating their findings to reflect this multiplicity of different ways of counting, measuring and analyzing, is a task many feel they do not have the tools to manage (Hammond & Dubé, 2012). Despite this, at the level of responsible food consumption, the Holon of food security is retained. The human centric-ness of food systems is acknowledged:

humans are growers, cooks and consumers of food and are the active agents of food systems who are fundamentally influenced by the system, but at the same time shape the system itself through their varied actions and decisions (Choi, Foth and Hearn, 2014, p2).

Reflection on contributions of Systems Thinking and Service Design

Reflecting on the use of Systems Thinking to express the problem space and Service Design as the vehicle for shaping the design intervention, several outcomes can be distinguished:

A better understanding of the overall situation, but also useful gap identification of where more knowledge is needed.

Service designers are well aware that by increasing the understanding of the situation, by capturing and eliciting information from stakeholders, they are able to make small, often low cost or no cost interventions that make services run smoother.

Less explicitly, these exercises serve to increase the collaboration between the stakeholder communities, so that the behaviour of the system is a result of co-created value propositions shared between the human elements.

Concerning the wider system. Smoother interaction and co-produced value between stakeholders, as a result of Service Design interventions, may ignore others who are not directly involved, but who are

⁶ <http://www.fao.org/save-food/resources/keyfindings/en/>

⁷ Sainsbury's: <https://wasteless.savemore.sainsburys.co.uk/food-rescue>

⁸ <http://www.liverpoolecho.co.uk/whats-on/grim-reality-hunger-food-poverty-11831426>

affected by the wider system. Using Systems Thinking and actively creating a Holon that is a shared understanding of the wider problem space, allows for more wide-ranging or 'systemic' interventions to bring about longer lasting results.

Lastly, referring to the hypothesis of products as 'by-products' of Service Design (Darzentas & Darzentas, 2016), it may be seen as a re-prioritising of the service over product. It points to the need to understand the problem space before designing the artefacts in it. It also means that the service will not be constrained by the needs of the specific product (s).

The ecological, economic and humanitarian imperatives that underlie efforts to deal with these global challenges mean that we should marshal all forces at our disposal. Service designers, who are proficient in Systems Thinking will be able to bring clarity and foresight into interventions, whether at a policy or grass-roots level, that could help bring about the systemic changes required.

Conclusions.

What is of interest to the systemic design community is the use of systems thinking to capture understand and learn about a Holon. That way, amongst other things, the beliefs, intentions, opinions and motivations of the stakeholders may be articulated. As a result, it should be possible to map these to form new directions, or to give voice to previously unexpressed aims and interests. For example, during the RSD6 symposium, participants gave voice to similar problems of multidisciplinary results integration, as well as problems of envisaging longer term goals on the way to achieving the grand vision. Much of the work dealing with sustainability acknowledges these obstacles, and although there are many suggestions (more awareness campaigns, better studies of human behavior, more stringent legislation) many of these suppress as many motivations as they encourage.

Going back to the theme of collaboration in multi-stakeholder initiatives, this work could serve as an exemplar for other similar projects. In systemic terms, the project has, through the interests of the stakeholders, recognised, amongst other things, emerging themes and properties in their worlds: for instance, consumers, retailers and producers who are linked in a food supply chain, but who as groups of individuals themselves have many other co-existing interests and motivations some of which may be quite closely aligned. After all, whether one is a producer or a retailer, we are all consumers. Similarly, researchers, coming from different disciplines, also with differing expectations about methodologies and end goals. For some, data collection and analysis is a goal in itself, while for others, emergent findings, while not part of the original brief, lead into interesting side research, that does not immediately seem connected to the original research aim.

Collaborating together to articulate the larger vision can put longer term visions into focus, as well as allowing for more immediate technologically oriented support. In this way it aids envisioning more possible ways forward. The next step is to formulate ways to move the larger vision into design interventions, inspired by the paradigm of service design (i.e. services are the main output, whether these are delivered with technological support or via other means). For this, the boundaries, interrelationships and functions of each of the directions to be taken need to be articulated, in order to understand where the interdependencies lie, and how some features may affect interrelationships. For instance, a mobile app to provide on-the-spot advice may obviate food purchases that could be wasted. However, this could mean that gifts of food that are part of culture

or opportunistic food purchases that are part of many consumers enjoyment when out shopping, will not be catered for.

The expectation is, that if each of the themes is able to report back, not just on the data collected and analysed, or the implementations they have developed, but on the results expressed in systemic terms (boundaries examined, elements considered, interrelationships revealed, and functions (or activities) existing or desired), then there is a possibility to mutually understand concepts and potentially identify common findings, in order to create and maintain collaboration that is both initiative-wide and of strong practical use. The problem space is one where many stakeholders are working independently, within and without the IKNOWFOOD project, all the while contributing to the large vision, in their own unique ways. We have a sense that although various groups involved in this collaboration will naturally disband and go their separate ways once this particular project is over, the experience of collaboration using Systems Thinking approaches and service design could also be instrumental in spawning interests that could be developed further by individuals, as well as inspiring others to join them to form new communities. What this would mean is that design interventions can look towards these outcomes too.

In this we are considering design and designers according to Buchanan's Four Orders of Design (Buchanan, 2001), Designers as thinkers rather than Designers as facilitators (3rd order). We want to draw on the power of Systems Thinking along with a service design perspective to bring designerly thought and design intervention approaches, into the processes that are traditionally used to carry out research to ultimately support collaboration in multidisciplinary research and better integration of results, thus contributing to dealing with Grand Challenges.

References

Blizzard, J.L & Klotz, L.E. (2012) A framework for sustainable whole systems design *Design Studies* 33(5), 456-479

Bosch, O. J. H., King, C. A., Herbohn, J. L. Russell, I. W., Smith, C. S.(2007) Getting the big picture in natural resource management—systems thinking as 'method' for scientists, policy makers and other stakeholders - *Systems Research and Behavioral Science* 24 (2) 217-232

Buchanan, R. (2001) *Design Research and the New Learning Design Issues: Volume 17, 12 Number 4 Autumn 2001*

Charnley, F., Lemon, M. & Evan, S. (2011) Exploring the process of whole system design *Design Studies* 32 (2), 156-179

Checkland, P. (1981) *Systems Thinking, Systems Practice* Wiley

Checkland P. (1988). The Case for 'Holon', Guest Editorial, *Systems Practice*, 1(3), 235-238.

Choi, J.H. Foth, M., and Hearn, G. (2014). *Eat, Cook, Grow: Mixing Human-Computer Interactions with Human-Food Interactions*. Massachusetts, The MIT Press.

Committee on World Food Security (CFS) *Global Strategic Framework for Food Security & Nutrition (GSF) Fourth Version – 2015* Retrieved from www.fao.org/3/AV031e.pdf

Darzentas, J. & Darzentas, J.S. (2016) Product-Service Systems or Service Design 'By-Products'? A Systems Thinking Approach Proceedings of the Design Research Society Conference 2016, <http://www.drs2016.org/506/>

Darzentas, J & Darzentas, J.S. (2014) Systems Thinking for Service Design: a natural partnership Proceedings of Relating Systems to Design Symposium (RSD3) [https://systemic-design.net/rsd3-proceedings/Development Initiatives \(2017\).](https://systemic-design.net/rsd3-proceedings/Development%20Initiatives%20(2017).)

Dorst, K. & Kaldor, L.(2016) Designing for the Common Good BIS Publishers B.V.

FAO, UN. (2003) Trade Reforms and Food Security: Conceptualizing the Linkages Retrieved from <http://www.fao.org/docrep/005/y4671e/y4671e06.htm>

FAO, UN (2009). Declaration of the World Food Summit on Food Security. Rome: Food and Agriculture Organization of the United Nations. Retrieved from http://www.fao.org/fileadmin/templates/wsfs/Summit/Docs/Final_Declaration/WSFS09_Declaration.pdf

FAO, IFAD, UNICEF, WFP and WHO. 2017. The State of Food Security and Nutrition in the World 2017. Building resilience for peace and food security. Rome, FAO.

Flood, R. & Jackson, M. (1999) Creative Problem Solving: Total Systems Intervention Wiley

Global Nutrition Report 2017: Nourishing the SDGs. Bristol, UK: Development Initiatives retrieved from <http://www.globalnutritionreport.org>

Hammond, R.A & Dubé, L. (2012) A systems science perspective and transdisciplinary models for food and nutrition security. Proceedings of the National Academy of Sciences, 109,(31) 12356-12363

Jackson, M. (2003) Systems Thinking: Creative Holism for Managers Wiley

Jegou, F., & Manzini, E. (2008) Collaborative services. Social innovation and design for sustainability, Milano:Edizioni POLI.Design

Jones, P. (2014). Systemic design principles for complex social systems. In G. Metcalf (ed.), Social Systems and Design, Volume 1 of the Translational Systems Science Series, pp 91-128. Springer Japan.

Kimbell, L. (2009) 'The Turn to Service Design' in Julier, G. and Moor, L., (eds) Design and Creativity: Policy, Management and Practice, Oxford: Berg.

Lee, K. (2011) Beyond Blueprints and Basics: A Service Design Conference Report Design Issues, Volume 27(4), 95-100

Manzini, E. (2009) New Design Knowledge, (Viewpoint article) Design Studies 30, 4-12

Manzini, E. (2014) Making Things Happen: Social Innovation and Design Design Issues 30(1) p.57-66

Meroni, A. & Sangiorgi, D. (2011) Meroni, A. and Santgiorgi, D. Design for Services, Farnham, Gower

Nelson, H.G. & Stolterman, E. (2012). The design way: Intentional change in an unpredictable world. Second edition. Cambridge, MA: MIT Press.

Norman, D.A. (2009). The way I see it: Systems Thinking: a product is more than the product. Interactions 16, 5 (September 2009), 52-54. DOI: <https://doi.org/10.1145/1572626.1572637>

Sargut, G. & McGrath R G. Learning to Live with Complexity Harvard Business Review 89 (9), 68-76

Sevaldson, B. (2011). 'GIGA-Mapping: Visualisation for complexity and Systems Thinking in design'. In Proceedings of Nordic Design Research (NORDES 2011). Retrieved from <http://ocs.sfu.ca/nordes/index.php/nordes/2011/paper/view/409/256>

Sevaldson, B. (2017). 'Redesigning Systems Thinking'. FORMadademisk Vol 10, No 1.

SOFI 2017 (State of Food Insecurity) retrieved from <http://www.fao.org/state-of-food-security-nutrition/en/> (full report)

Valtonen, A. (2010) Is systemic design the next big thing for the design profession? Proceedings of design Research Society Conference 2010 retrieved January 2014 from <http://www.designresearchsociety.org/docs-procs/DRS2010/PDF/121.pdf>

Acknowledgements:

We thank the IKNOWFOOD research project <https://iknowfood.org/>.

Professor John Darzentas is a Leverhulme Visiting Professor at the University of York and Dr Jenny Darzentas is a Marie Skłodowska-Curie Experienced Researcher Fellow funded by the European Union.