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Swart, J.A.A.; van de Poel, I.R.

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Chapter 9. Corporate social responsibility and hybrid potato breeding: balancing economic, environmental and social challenges

J.A.A. Swart[1*] and I. van de Poel[2]

[1]Integrated Research on Energy, Environment and Society (IREES) of the Energy and Sustainability Research Institute Groningen (ESRIG), Groningen University, Nijenborgh 6, 9747 AG Groningen, the Netherlands; [2]Department Values, Technology & Innovation, School of Technology, Policy and Management, Delft University of Technology, Jaffalaan 5, 2628 BX Delft, the Netherlands; j.a.a.swart@rug.nl

Abstract

Hybrid potato breeding is an emerging technology that can have a strong impact on the potato sector by replacing seed potatoes with true seeds. The Netherlands is a world leader in certified seed potatoes and a number of Dutch companies play a pivotal role in the development of this technology. This implies a certain responsibility for the consequences and conditions of its implementation and we therefore explored how Dutch potato breeding companies see their role and responsibility especially in low- and middle-income countries in the context of the United Nations Sustainable Development Goals (SDGs). From interviews, it appears that most potato breeding companies emphasise the promising role of hybrid potato breeding in achieving SDGs. They also stress that their core business is at the heart of corporate social responsibility as it contributes to the SDGs. We also observed that for the introduction of new varieties they often rely on trickle-down mechanisms, where local farmers are rather passive recipients, rather than being actively involved in strategic choices of innovation. It may explain why the concept of responsible research and innovation (RRI), which emphasises the active involvement of society and affected stakeholders, is relatively unknown in the sector. The main approach in the sector may be labelled as a 'solution strategy' where dominant actors rely on their expertise to solve problems. However, the attainment of SDGs should rather be considered as a wicked problem, characterised by complexity, uncertainty and multiple actor's perspectives. A 'negotiation strategy', which is more inclusive and stresses the need of negotiation between different perspectives and interests, may fit better. From the perspective of RRI it is argued that insights from participatory breeding and farmer variety selection traditions and the concept of benefit sharing may be considered as promising negotiation strategies that can contribute to potato breeding practices for the attainment of SDGs.

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9.1 Introduction

As an emerging innovation in potato breeding, 'hybrid true potato seed' (HTPS) technology has the potential to contribute significantly to the Sustainable Development Goals (SDGs) of the United Nations. This is especially relevant for low- and middle-income countries (LMICs) where potato is an important staple crop. The Dutch seed potato sector as a dominant actor in certified high quality seed potatoes may potentially play an important, if not decisive role, in exploiting this potential. Indeed, several Dutch companies, i.e. Solynta, HZPC, and Aardevo, are currently developing diploid hybrid potato varieties and expect market introduction within a couple of years, while Bejo has already registered a tetraploid hybrid variety. In this chapter we aim to critically reflect on what role Dutch potato companies see for themselves in this respect, what opportunities and uncertainties they perceive, and which strategies they follow.

To this end, we investigate the activities of Dutch potato companies through the lens of 'corporate social responsibility' (CSR) and 'responsible research and innovation' (RRI). CSR has been defined as 'the responsibility of enterprises for their impacts on society' by the European Commission (2011), while RRI has been understood by the European Union as 'the on-going process of aligning research and innovation to the values, needs and expectations of society' (EC, 2014). The core idea of both CSR and RRI is that companies should in their operations respect societal values as well as contribute to the so-called Grand Societal Challenges (Voegtlin *et al.*, 2022), like SDGs.

This chapter is structured as follows. We first shortly discuss existing potato production systems and the potential contribution of HTPS. We then introduce the concepts of CSR and RRI in the context of the SDGs. The following section presents our research questions and methods. Subsequently, we describe the results of our empirical investigation based on interviews with Dutch potato breeding companies. The next section outlines our conclusions with respect to our empirical research questions. In the final section, we critically reflect on our findings, and we will make suggestions how Dutch potato companies can develop strategies that help better exploit the potential of HTPS for LMICs.

9.2 Potato production systems and the potential impact of HTPS

Farmers in LMICs mostly rely for their food on traditional crop varieties which are adapted to local conditions as part of what is called the 'informal agricultural or seed system'. In such systems, farmers mostly rely on own farm-based seeds and tubers, without a clear separation between seed selection, seed production, and seed diffusion, which happen mostly within the local farming community (Louwaars and De Boef, 2012).

Informal seed systems are characterised by institutional organisation and labour relations that are mostly based on casual employment, kinship, or personal or social relations instead of contractual arrangements. Informal systems are further characterised by an absence of specialisation, low

capital investments, small enterprises, mingled with a focus on non-farming components, a dominant role for women, and no or a limited role for formal institutions. Innovations are often more social than technical (Chakrabarti, 2014). Thus, the informal system is not just a seed system but rather a community system (Lammerts van Bueren *et al.*, 2018).

In contrast, formal seed systems are characterised by clearly distinguished steps in the value chain, sometimes performed by different organisations and companies with regard to breeding, multiplication, production, marketing, and retail (Figure 9.1). Potato breeding companies, which are mostly based in high income countries (HICs), have an important role and are often organised through branch organisations. Formal systems are strongly guided by scientific methodologies, controlled multiplication and production. Policy and legal frameworks play an important role through facilitating investments in breeding, regulating access to genetic resources, and ensuring seed quality. Yields in formal systems are much higher as compared to informal systems. Whereas potato yields of 40 t/ha are possible in HICs such as the Netherlands, East African yields often remain below 10 t/ha (De Vries *et al.*, 2016).

According to the International Labour Organization (ILO, 2018), worldwide more than 60% of world's employed population is in the informal economy and for Africa this is more than 85%. However, there is no sharp line between the formal and the informal system. They may interact and some farmers dovetail informal and formal farming, which may infuse new varieties and knowledge into the informal system. Formal systems may also utilise genetic resources from the informal system in order to develop varieties with particular traits (Figure 9.1).

Application of HTPS in the informal system may include several cultivation strategies varying from sowing true potato seed directly by farmers, to seed tuber production by companies based on hybrid true potato seeds. It has the potential to contribute to an improvement of potato production in LMICs, and so to the achievement of Sustainable Development Goals (SDGs) in particular SDG-2 aimed at food security and sustainable agriculture (see other chapters in this volume and UN-DESA, n.y.). The knowledge and skills required to make HTPS technology a success, however, largely stem from the formal seed system, in which Western potato companies

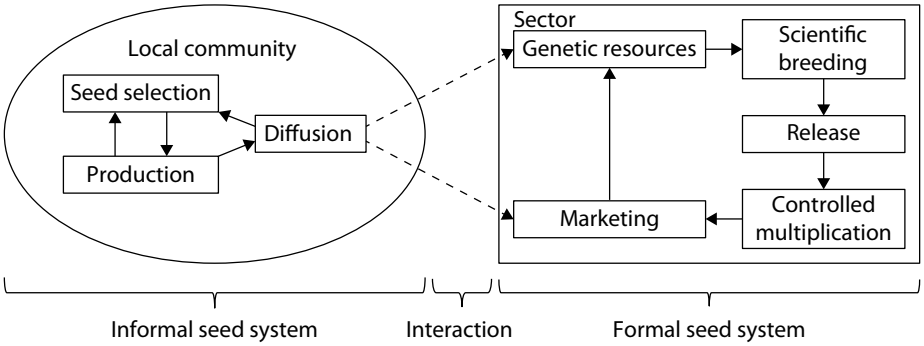

Figure 9.1. The informal and formal seed systems and some interactions between them (after Louwaars and De Boef, 2012).

are dominant. The introduction of HTPS in LMICs may lead to a greater dependence of small farmers on Western breeding companies. It will require adaptations of current farm-based systems to the formal system. However, farm-based seed systems are often embedded in local community structures and seed interventions are therefore complex, far-reaching, controversial and will fail if the local community and its local knowledge is not involved or at least considered (Almekinders *et al.*, 2019; Stemerding *et al.* 2021; see also Chapter 7).

While exploiting the potential of HTPS in LMICs may be in the self-interest of Dutch potato companies, there are a number of reasons to assess this technology through the lens of both CSR and RRI. First, the market in LMICs is uncertain and some companies might therefore prefer for economic reasons to focus on Western markets, ignoring the SDG-potential of HTPS technology in LMICS. CSR may motivate to keep the SDG perspective in focus. Second, what is required is much more than the commercial availability of hybrid potato seed, plantlets or tubers. Rather, the innovation will affect – as described above – the existing informal potato production system, and from a CSR and RRI perspective these effects should be taken into account in the company's innovation and marketing strategies. In particular, it will require tailoring hybrid technology to the local circumstances and requirements of farmers in the informal system.

9.3 Corporate social responsibility and responsible research and innovation in the context of Sustainable Development Goals

Like other global societal challenges, SDGs are complex, uncertain and value-laden (Voegtlin *et al.*, 2022). This is because their attainment requires a combination of social, institutional, technical, economic and political measures, taking into account diverse socio-technical system conditions. We only partly understand these challenges and conditions and we also lack agreement on how they can be best understood. They are value-laden, in the sense that value judgements are required in both understanding and addressing them. Realising SDGs is therefore best seen as an unstructured or 'wicked' problem (Ludwig *et al.*, 2021). In contrast to structured or 'tame' problems there is no agreed formulation of what the problem is about. Different stakeholders may perceive the problem differently and also radically disagree about solutions (Rittel and Webber, 1973).

Considering abating hunger as a tame and straightforward problem that can be solved solely by better varieties and higher yields, ignores underlying factors and causes associated with social injustice, political interests, and institutional and legal shortcomings in the food system. In this context, various authors have discussed how companies through CSR and RRI can respond to wicked problems (Imaz and Eizagirre, 2020; Ludwig *et al.*, 2021; Voegtlin *et al.*, 2022).

9.3.1 Corporate social responsibility

Corporate Social Responsibility (CSR) is a management concept stressing that it is not only the interests of the owners of a company (shareholders) and the employees or suppliers (direct stakeholders) that count, but also wider social and environmental issues and imperatives. According to the UN Industrial Development Organization (UNIDO, n.d.):

> 'corporate social responsibility is a management concept whereby companies integrate social and environmental concerns in their business operations and interactions with their stakeholders. CSR is generally understood as being the way through which a company achieves a balance of economic, environmental and social imperatives ('Triple-Bottom-Line-Approach'), while at the same time addressing the expectations of shareholders and stakeholders.'

CSR is often linked with the UN SDGs in the sense that it asks for how much a company can or will contribute to these goals. According to the United Nations Global Compact[5], currently, world-wide 14,272 companies (including large, medium, and small companies) have signed up to the 10 CSR Global Impacts principles of the UN, which implies a commitment to contributing to the UN SDGs.

CSR has sometimes been criticised as being too reactive and being too much based on instrumental and symbolic reasons rather than a contribution to society. Porter and Kramer (2006) therefore argue that CSR should be closely connected to corporate strategy in the sense that it should not be restricted to philanthropy, but rather should closely connect to the core activities and corporate strategy of the company. The company should ask itself: how can we contribute to wider society and to the UN SDGs, while making a profit? This requires the development of a corporate strategy that adds value for the company as well as for the wider society.

CSR has also been criticised as being based too much on voluntary commitments and being used instrumentally for avoiding government regulation. The experiences with Responsible Care in the chemical industry since the 1980s are instructive (Givel, 2007; King and Lenox, 2000). Responsible Care is an industry-wide initiative to improve the environmental and safety performance of chemical companies. It is aimed at creating a set of minimal, but voluntary, rules that the whole industry should abide by, thus creating a level playing field. The idea was that it would become attractive for all companies to live by the rules and thereby to contribute to a better image of the chemical industry as a whole. At the same time, it has been criticised as an attempt to postpone government regulation. One of the important lessons learned from Responsible Care in the chemical industry is that it is important to have some form of external auditing to check whether companies indeed live up to such voluntary self-regulatory codes.

9.3.2 Responsible research and innovation

The concept of RRI in particular stresses the need for opening up the innovation process to a wider range of moral concerns and societal stakeholders (Von Schomberg, 2013). RRI stresses four conditions that should be taken into account with respect to research, technology development and innovation efforts of an organisation (Stilgoe *et al.*, 2013):

- anticipation: innovation should take into account potential future developments;
- inclusiveness: involve stakeholders and the public;
- reflexivity: reflect on underlying value systems;
- responsiveness: provide an answer to social concerns.

[5] https://tinyurl.com/2cuh2zvx.

There is limited experience with RRI in industry (Van de Poel *et al.*, 2017). One reason is that the concept is still rather unknown among industries, and that companies might feel that it requires quite substantial investments without immediate business benefits (Dreyer *et al.*, 2017; Gurzawska *et al.*, 2017). One suggested strategy to overcome this is to build on existing RRI-like activities that many companies already undertake, like for example risk assessment, life cycle analysis or strategic planning, and to broaden these with wider ethical concerns and the inclusion of stakeholders (Van de Poel *et al.*, 2020).

A more strategic barrier for RRI is that companies are often hesitant to allow other stakeholders access to their innovation process. An important reason is that innovation is often considered as the key to competitive advantage. Many companies therefore want to protect their innovations if not through intellectual property rights and patents then at least by keeping certain technical details and strategic considerations secret.

While traditionally CSR has been focused on preventing harm, a focus on SDGs would allow companies to make a positive societal contribution. It would, however, require companies to make CSR and their contribution to the SDGs not something accidental that is peripheral to their corporate strategy but part of the core activities of the firm (Imaz and Eizagirre, 2020). RRI is even more challenging as compared to CSR, because it opens up strategic business decisions and the company's innovation process to external influences from stakeholders that may be affected by the innovation (e.g. in their livelihood), but who do not have a commercial stake or share in the company itself (as most farmers in LMICs). As mentioned above, companies may be reluctant to do so because it may conflict with their commercial interests and constraints. As compared to CSR, it requires probably measures and steps above the level of individual companies to make it affordable.

9.4 Research questions and methods

This chapter aims to explore whether, and if so, how potato companies aim to contribute to societal goals, like SDG-2, through the development and use of HTPS technology. The Dutch potato sector is a strongly formalised system covering breeding, multiplication, production, storage, processing, and retail. In the Netherlands, so-called potato trading houses play an important role as they are active in breeding, multiplication, production, storage, and trading of potatoes. The sector has a strong international role as it is the world's major supplier of certified seed tubers that meet official phytosanitary, variety purity and general appearance requirements and are used to produce ware potatoes. The empirical questions we aim to explore in this chapter are:

1. How do companies view the significance of the hybrid potato and its impact on the Dutch sector?
2. What do Dutch potato companies consider as the potential SDG impact of this technology in LMICs, and what actions do they undertake or perceive to realise this impact?
3. Are Dutch potato companies actively exercising CSR, in particular in relation to the potential of HTPS in LMICs?

We explored these questions by means of scientific and grey literature and interviews with representatives of Dutch potato breeding companies active in hybrid breeding, i.e. Solynta, HZPC, Aardevo, and Agrico, a potato breeding and trading company that does not work on this technology. In addition, we conducted interviews with a representative from the Dutch plant breeding branch organisation Plantum and with spokespersons from organisations in the sector that are not active in potato breeding themselves: the Louis Bolk Institute and Oxfam Novib (Table 9.1). The interviews were conducted in the period August-October, and lasted about 1.5 hour. They were recorded, transcribed, and edited to make them more readable, after which they were checked by the interviewees to correct for inaccuracies. Finally, the draft of this chapter was read by the interviewees to check its accuracy. However, the authors remain fully responsible for the content. As we aim to critically assess the role that Dutch potato companies see for themselves, we also discuss a fourth, more reflective question:

4. What can we add to the opinions among stakeholders in the Dutch potato sector with regard to CSR and hybrid potato by considering these opinions through the lens of RRI?

9.5 Results

Below we describe and discuss the main results from our investigation regarding the three empirical research questions. The fourth research question is discussed later.

9.5.1 The significance of the hybrid potato

Our interviews indicate that three types of innovations can be distinguished through the emergence of HTPS technology: innovation in breeding, propagation and cultivation. 'Breeding innovation' implies an improvement and acceleration of the breeding process which makes it much easier to develop new varieties. However, the development of sufficient inbred parental lines is a lengthy process. The companies that are working on diploid potato hybrids have been working on this for 10 years or more. 'Propagation innovation' implies that true botanical seeds are used for propagation, storage and transport of potato starting material rather than traditional seed tubers. These true seeds are then subsequently used to produce seed tubers or table potatoes. However, local propagation by means of tubers once they are produced from seedlings remains possible, like the current practice of tuber propagation. The interviewees considered this as a significant aspect of hybrid potato breeding, which differs from most vegetable breeding practices where only true seeds are used for propagation. 'Cultivation innovation' involves direct sowing of true seeds in the field or planting plantlets grown from these seeds. This implies completely different forms of potato cultivation and has similarities with vegetable cultivation. According to the Plantum spokesperson, vegetable growers in particular might therefore pick up this innovation easier than traditional potato growers.

Table 9.1. Brief description of the companies and organisations of which one or more representatives have been interviewed for this chapter (based on the situation in 2021).

Company	Description
Solynta	A private seed company that was founded in 2009 by former employees of Monsanto to develop commercial hybrid potato technology. The company was the first to successfully develop HTPS technology based on diploid inbred lines that could be used for hybridisation. As a scale-up company, it has not yet a financial turnover in the seed market but raised 21 million euros in venture capital in 2021. The number of employees is ca. 70. The company currently focuses on the introduction of hybrid potato among smallholders in East Africa and is performing field experiments in this region. It has two hybrid varieties submitted for registration at the Dutch Board of Plant Varieties. Website: https://www.solynta.com
HZPC	A potato trading house organised as a two-tier board company where all shares are owned and certified by the 'Vereniging HZPC' (Association HZPC) with about 900 members. Only (former) farmers, (former) breeders and (former) staff members may purchase and hold certificates. The company comprises breeding, agronomic research, cultivation, and international trade of seed tubers and is active in 96 countries. Its financial turnover is ca. 320 million euro (harvest season 2020-2021). The number of employees is ca. 400. The company started its research on HTPS technology in 2009 after Solynta was established. It considers HTPS technology especially beneficial in and for LMICs in e.g. Africa and South East Asia. The company is currently performing field experiments in these countries. Website: https://www.hzpc.com/en
Agrico	A potato trading house organised as a cooperative with about 900 farmer members. The company comprises breeding, agronomic research, cultivation, and international trade of seed potatoes in 80 countries. Its financial turnover is ca. 293 million euro (harvest season 2020-2021). The number of employees is ca. 270. The company is not actively involved in hybrid potato breeding, but there is pre-competitive collaboration with companies involved in this technology. It also does not rule out the possibility of using this technology in the future by entering partnerships with companies working with this technology. Website: https://www.agricopotatoes.com
Aardevo	A joint venture of the American food company Simplot and the German seed company KWS. KWS is best known for breeding sugar beet, corn, cereals, and vegetable crops, while Simplot, a big name in potato chip processing, also focuses on many other crops as well as fertiliser and animal feed production. Aardevo does not produce itself commercial products but aims to contribute to both its parent companies by developing new potato varieties through diploid hybrid breeding technology. The number of employees is ca. 20. The company is engaged in diploid hybrid breeding since 2011 and focuses on the development of hybrid varieties for Northwest Europe and North America. Website: https://www.aardevo.com/en
Bejo	A private company engaged in breeding and trading of hybrid vegetable seeds. The company is active in more than 30 countries. Its financial turnover is ca. 325 million euro (harvest season 2020-2021). The number of employees is ca. 1900. The company started its research on TPS in the late 1980s and turned to hybrid tetraploid potato breeding in 2013 but also conducts research into diploid hybrid breeding. One hybrid tetraploid variety has already been officially registered at the Dutch Board of Plant Varieties. The company focuses with its hybrid breeding programme on Africa and Central America. Website: https://www.bejo.nl
Plantum	Dutch Branch association for plant breeders. It is organised in several crop breeding sections as vegetables, floriculture and also potatoes. A more overarching activity is representing general interests of its member breeding companies as e.g. research policy, breeding rights, phytosanitary issues and CSR issues. To this end, it consults, for example, with policymakers and as an employer's organisation with unions. As a branch organisation Plantum is also involved in societal discussions on role of breeding companies in food security policies. The number of employees is ca. 20. Website: https://plantum.nl

Table 9.1. Continued.

Louis Bolk Institute	A knowledge not-for-profit institute that previously operated mainly from a biodynamic vision, but nowadays aims to stimulate sustainable forms of agriculture from a holistic system perspective, given that most food is still produced with less sustainable, conventional agricultural methods. The institute has 55 employees and its financial turnover is about 4.5 million. The institute does not breed crops itself, but mainly tries to generate practical knowledge that has an impact on the farming business itself through collaboration with Wageningen University as well as companies. Website: https://louisbolk.nl/en
Oxfam Novib	Dutch development NGO affiliated with OXFAM International. The NGO is mainly active in African and Southeast Asian LMICs. It focuses on numerous themes such as poverty, hunger, refugee aid and women's rights. Oxfam Novib emphasises and promotes the important role of informal seed systems and smallholder farmers in plant breeding, seed production and agro-biodiversity conservation. Website: https://www.oxfamnovib.nl/donors-partners/about-oxfam/our-story

Four of the five breeding companies we interviewed consider the emergence of HTPS as an important innovation in breeding, cultivation and trading of potatoes. Faster breeding of potato varieties; easier cross-breeding of desirable characteristics such as disease and salt resistance; higher productivity; faster propagation of starting material; and lower storage and transport costs are mentioned advantages. However, Agrico has a more neutral stance about the technology and it believes that current tetraploid, non-hybrid breeding can meet the diverse requirements of growers and markets already quite well.

HZPC's strategy focuses on what we have called breeding innovation as it is for this company primarily a way of generating new and better varieties which can more easily be exported through true seeds to other countries, where they can be propagated in the traditional way through seed tuber production. Because vegetative propagation of hybrid seed potatoes is still possible, financial margins are lower as compared to non-potato crops. According to the company, seed tuber cultivation is therefore not really threatened and may even increase in some countries because new hybrid varieties can perhaps grow in areas where this is currently not possible, e.g. tropical lowlands.

The company Bejo is cautious about diploid hybrid breeding of potatoes and focuses mainly on tetraploid hybrid breeding. Although the uniformity of tetraploid hybrids is lower as compared to diploid hybrids, it is similar to other vegetables; a very high uniformity is according to this company only necessary in some cases (such as growing potatoes for crisps).

As newcomers in the sector, Solynta and Bejo both emphasise, besides breeding innovation, also propagation and cultivation innovation as a characteristic of the HTPS technology. According to Solynta, new hybrid varieties will be introduced every few years by means of hybrid breeding and it expects that Dutch cultivation and the worldwide export of seed tubers may even disappear in the longer term. According to the company, potato growing will become similar to vegetable cultivation, with fast variety turnover, which is not possible with conventional breeding.

However, propagation innovation requires that hybrid seed can be produced in sufficient amounts through the crossing of two parental lines. According to the Bejo spokesperson, this is a problem with diploid hybrid breeding because potatoes have never been selected for high seed production due to the conventional tuber propagation. This was a reason for the Bejo company to focus on tetraploid breeding where true seed production is higher. Low real seed production is currently not an important issue for HZPC as this company mainly focuses on breeding innovation and not on propagation.

Although the interviewees indicated that the Dutch potato sector will not be strongly affected by hybrid breeding in the short term, it has already led to the entry of new companies like Bejo and Solynta in the breeding sector. Both have an origin in vegetable breeding. Also the parent companies KWS and Simplot of the Aardevo joint venture do not belong to the traditional seed potato breeding and trading companies. The changing playing field is also reflected in the views on intellectual property rights. According to the spokespersons of both trading houses, HZPC and Agrico, the plant breeders' rights system is well-functioning and promotes innovation through the right to use protected varieties for one's own breeding purposes. The spokesperson for the Louis Bolk Institute also endorses this. According to HZPC, patents on genetic traits are not desirable and may inhibit further development. And, so far as patents exist, they should be made available for all actors in the sector. Conversely, the companies coming from outside the conventional potato breeding tradition, believe that patents have and should have a role in hybrid breeding because of the high costs of hybrid breeding. Another consequence that surfaced in the interviews is that the emergence of hybrid breeding may lead in the longer term to disappearance of smaller potato breeding companies because this technology is expensive and it takes many years to develop the required parent inbred lines.

9.5.2 The perceived potential of hybrid true potato seed in low- and middle-income countries

As Figure 9.1 shows, the informal and formal potato systems are quite separate worlds, despite some interactions. Because of its scientific and technological background, HTPS technology may primarily be considered as part of the formal sector. This fits to the strategy of Aardevo, which focuses on North America and Northwest Europe, although a spill-over effect is conceivable towards LMICs in the longer term. In contrast, Solynta, HZPC and Bejo focus primarily on LMICs (in East Africa or East Asia) with their hybrid potato breeding efforts. Also the Louis Bolk Institute expects the greatest application of hybrids in LMICs. This is because the prospects for improvement in terms of increasing production and reducing diseases are highest in these countries and also enable new business opportunities. According to the companies, working on HTPS, the technology can make a significant contribution to the SDGs, especially with regard to food security and sustainability. The spokespersons for Plantum, the Louis Bolk Institute and Oxfam Novib endorse these potential benefits.

An important question therefore is what the impact of the hybrid potato could be in LMICs. Growing potato crops directly from diploid hybrid seeds or plantlets is not expected to be done by farmers in LMICs themselves as it requires a lot of knowledge, skills, and experience. It is more

likely that special nurseries will be created to produce seedling transplants or seedling tubers. These nursery companies will probably sell high-producing tubers or plantlets to the larger farmers in these countries and may therefore function as 'boundary spanners', i.e. actors that enable the translation of information over knowledge and social boundaries, between the formal and informal system (Tushman, 1977). We have visualised this in Figure 9.2. However, the company Bejo indicates that for their tetraploid hybrids such nursery companies are not necessary because their varieties are stronger and more resilient and the true seed will be sold to, and grown directly by farmers, just as with vegetables.

As a conclusion, the interviewees expect that vegetative propagation through tubers will still take place in LMICs with the hybrid true seed varieties. But it is expected that there will still be a continuous demand for healthy hybrid starting material because diseases will accumulate in subsequent seasons. It is also expected that through a trickle-down process, in which farmers in a village or neighbourhood pass on tubers to each other or buy them on local markets, these varieties will gradually reach smallholders in the informal sector and from there a continuous demand for these varieties may also arise, especially if they perform better.

Such a trickle-down process raises the question to what extent the breeding companies will enforce their breeder's rights on the new varieties in LMICs. Informal exchange of seeds is a strongly culturally embedded practice in these countries and in practice it is difficult to enforce plant breeders' rights in such contexts. The answers of our interviewees indicate that except for larger, more commercial companies, companies will probably not enforce their rights on smallholders, similar to the current situation with traditional potato varieties. Nevertheless, Oxfam Novib indicated that there are still concerns that commercial potato breeders will enforce their breeders' right towards small farmers in the future.

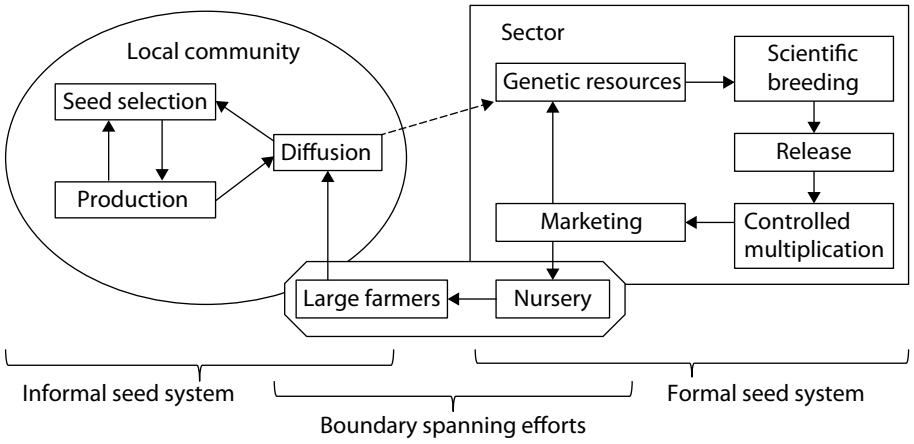

Figure 9.2. Hypothetical role of a nursery as a boundary spanning effort between the formal and informal system of hybrid potato cultivation, see also Figure 9.1.

Hybrid varieties played an important role in the Green Revolution which sparked a lot of discussion about the possible disappearance of local varieties, increased farmers' dependence on external inputs of seeds, fertilisers and pesticides, and financial constraints on farmers (Kloppenburg, 2004). In general, these effects were not expected to occur with HTPS. According to our interviewees, farmers are already well-acquainted with hybrid crops (e.g. vegetables, cereals) and the inputs they require.

9.5.3 Corporate social responsibility activities of Dutch potato companies

Two interpretations of CSR emerged from our interviews. On the one hand, CSR concerns concrete, performative business operations to meet legal, social and health standards. This refers to the companies' contribution to, for example, CO_2 reduction, the prevention of child labour, and good employment practices. On the other hand, the interviewees strongly emphasised that CSR is also about the company's contribution to SDGs through the development of better potato varieties and the delivering of these to LIMCs. In line with the suggestion made by Porter and Kramer (2006) (see an earlier section of this chapter), most interviewees considered their core business as an CSR-effort itself as it contributes – in their view – to the world food supply, poverty reduction and sustainable production. For example, HZPC mentioned that it is prepared to supply seed potatoes to countries at war in the Middle East if the food situation so requires, even if that implies some financial risks and conflicts with international rules.

According to the breeding companies, potatoes can help achieve SDGs because this crop is not only the fourth food crop in the world, but also the most efficient crop in the world in terms of production per hectare and water use. Further breeding of the potato may contribute even more to food security, higher yields, reduced pesticide use, disease resistance, salt resistance and storage properties. In order to make that contribution, the companies active in LIMCs, emphasise the role of capacity building and the need to have offices or departments in these countries. Most of them also conduct field trials there, and maintain contacts with companies and institutions that are relevant for this. We referred to these previously as boundary spanning efforts (Figure 9.2).

This second interpretation of CSR, i.e. the focus of CSR on SDGs, applies to both conventional and hybrid breeding, whereby hybrid breeding may lead to faster development of varieties and more easily incorporation of new traits. It is one of the main reasons for adopting this technology. The view that contributing to food production for the world market and LMICs is to be considered as a kind of CSR was supported also by the Louis Bolk Institute. However, the interviewees from Plantum and Oxfam Novib indicated that CSR in their opinion requires additional activities that go beyond contributing to the SDGs through the company's core business, such as taking the perspectives of local farmers as a starting point or even actually involving them in the company's core business.

The interviewees indicated that the costs of CSR do not play a major role in taking CSR measures. They argue that CSR should be considered as a prudential activity in the longer term that also may contribute to the public reputation of the company. But ultimately, CSR must fit into the financial

constraints within which a company has to operate. Both Agrico and HZPC publish reports in which their CSR policy is paying attention to both distinguished interpretations of CSR. These companies are active across the entire value chain (from breeding to the export of seed potatoes) and are present in multiple countries. HZPC issues a biennial CSR/sustainability report that is produced by an external party using the Global Reporting Initiative Standards (see https://www.globalreporting.org). Agrico employs a special CSR officer and adheres to Dutch NEN standards (https://www.nen.nl/en) when drawing up the CSR report. However, there are no external audits of these reports. The other breeding companies, which mainly focus on breeding and trading (hybrid) seeds and not tubers, do not have public CSR reports but they endorse the importance of corporate responsibility, care for the environment, social security, care for employees and cooperation with farmers.

9.6 Preliminary conclusions

Based on our results we can answer our empirical research questions as stated before:

- Hybrid potato breeding implies three types of innovations, namely a breeding, propagation and a cultivation innovation.
- All but one of the interviewed companies and organisations are positive about the potentialities and impact of hybrid breeding.
- Although it is not expected that the Dutch potato sector will strongly be affected by the emergence of HTPS technology in the shorter term, we see the entry of new firms which stronger stick to the possible use of patents on genetic traits.
- All companies active in hybrid breeding (fore)see a significant contribution to SDGs of this technology.
- The impact of hybrid breeding on the informal sector in LMICs is, according to most of our interviewees, likely to go through the classic trickle-down process.
- In contrast to tetraploid hybrid breeding, diploid hybrid breeding will probably lead to the establishment of special nursery companies supplying starting material to local farmers.
- It is expected that future practices of dealing with plant breeders' rights will probably not deviate much from the current situation.
- Worldwide, potato production may increase locally through improved varieties that can be grown at places where this is currently not yet possible.
- All interviewees endorse the importance of CSR. Besides concrete measures as care for the environment, social security and care for employees, the possible contribution to SDGs by trading improved varieties (as core activities of the breeding and trading companies) is in itself considered as CSR.
- Costs do not play a major role in taking CSR measures, although they must fit within the financial constraints in which the companies operate.
- Only the trading companies in our set of interviewees publish public SCR and/or sustainability reports using external criteria.

Thus, as a general conclusion, most of our interviewees stressed the potentially promising contribution of HTPS to the attainment of SDG-2 (see also Lindhout *et al.*, 2017). Moreover, they emphasised that their core business (i.e. breeding, cultivating and/or trading potato varieties) is

at the heart of CSR as it contributes to the SDGs. More specifically, hybrid breeding is expected to contribute to the SDGs through the development of improved varieties that will subsequently trickle down to the informal sector.

9.7 Towards an RRI-based strategy for hybrid breeding

Although most companies we interviewed see themselves as making a contribution to the SDGs in LMICs, they tend to state this contribution in terms of 'trickle-down', in which local farmers are just passive receivers, rather than being actively involved. As observed above, this reluctance to address local requirements and to include farmers in technological innovation may in part be due to the unfamiliarity of RRI in industrial circles and the need to keep certain technical processes secret as a company's main competitive asset. Obviously, HTPS technology can be considered such an asset. This raises the question what companies can additionally do to contribute to SDG-2 (food security and sustainability) and how RRI as an approach might help them in this respect.

As described above, SDGs may be considered as wicked problems that are characterised by complexity, uncertainty and the involvement of multiple actor's perspectives and values. According to Ludwig *et al.* (2021) such wicked problems are 'commonly mis-framed as tame problems that appeal to the expertise of dominant actors and their responses as solutions.' In this context these authors distinguish two strategies: 'a solution strategy that legitimises the responses of dominant actors as solutions, and a negotiation strategy that highlights the contested status of grand societal challenges and the need for negotiation between heterogeneous interests and perspectives (p. 2).

We observe that the interviewed companies, as dominant actors, mainly apply the solution strategy, as evidenced by low or no active involvement of local farmers or their representing organisations in the HTPS technology itself and the expectation that the new varieties will spread through a trickle-down process.

While a solution strategy may be useful and can lead to a substantial contribution to SDGs, it may be nevertheless in danger of not being accepted by relevant stakeholders as it may ignore the root cause of a problem, or being too inflexible to deal with local conditions and insights (see also Chapter 2). In contrast, a negotiation strategy considers different responses to a wicked problem and does so in conversation with a wide range of stakeholders. It is therefore more inclusive and deliberative in nature. Below, we explore participatory plant breeding (PPB), farmer variety selection (PVS), and benefit sharing as possible negotiation strategies for hybrid potato breeding in LMICs. PPB and PVS may help companies to do more justice to local needs, and to the diversity among farmers in LMICs. Benefit sharing may be necessary to ensure that HTPS technology remains accessible for local farmers in LMICs. Together, PPB, PVS and benefit sharing make up, we believe, viable RRI strategies for potato companies that want to contribute to SDG-2 through a negotiation strategy.

9.7.1 Responsible innovation with regard to breeding: involving smallholders in potato breeding

The concept of RRI emphasises the responsibility of those in control of a technology for possible negative consequences for society and the environment. It also stresses the involvement of and responsiveness towards affected stakeholders. We think that the concept of PPB may suggest ways to bring RRI into practice in potato breeding. PPB is defined by Ceccarelli and Grando (2020: p. 1) as 'the participation of clients (more often, but not only, farmers) in all the most important decisions during all the stages of a plant breeding program'. PPB is aimed at achieving food sovereignty, i.e. 'the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems' (Nyéléni, 2007). According to Ceccarelli and Grando (2020), PPB is an alternative ('a reversal') of the dominant seed system in which 'agricultural production, seed production, varietal innovation, and conservation of genetic resources are functionally separated and delegated to specialised scientists' (p. 10). The authors distinguish several stages in the so-called breeding cycle (Figure 9.3).

Especially stage 7 is interesting as it highlights the step of deciding who will participate in the process, which is not only a knowledge but also a social and cultural issue. Participatory breeding requires however more than just the participation of farmers in the breeding cycles. It also raises the question how practical farmer knowledge of varieties (in their own agronomic context) can be integrated with techno-scientific knowledge (Almekinders, 2011). In addition, PPB often aims to use local varieties (i.e. varieties adapted to the local context with regard to climate, soil, flavours, cooking traditions, etc.). Because of this, issues as ownership and property rights might be at stake.

Incorporating hybrid breeding in PPB makes the breeding cycle more complicated through the technical and scientific work needed for development, improvement and maintenance of parental inbred lines. These activities often take many years and may be considered as part of stage 3 in Figure 9.3. One of the issues at stake here is the practice of secrecy, and we may also question if farmers can really play a decisive and direct role in this often highly technological stage, but public scientific institutions could have a role here.

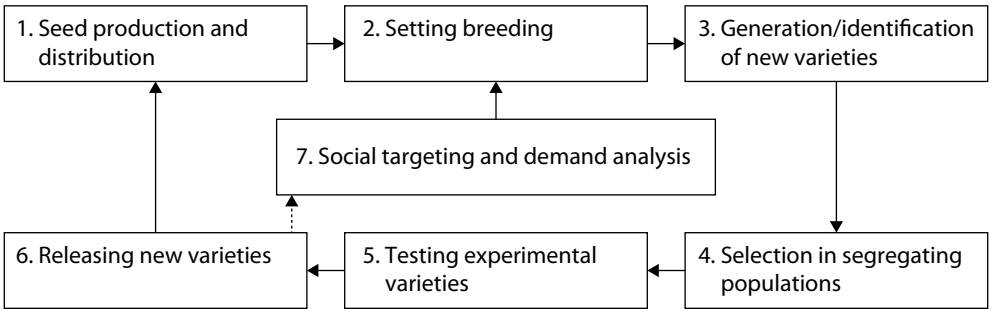

Figure 9.3. Schematic overview of the stages in the breeding cycle in general (based on Ceccarelli and Grando, 2020). The dashed arrow probably indicates that stage 7 may also be passed, implying the absence of societal interaction.

Although Li *et al.* (2013) argue that PPB is still possible with hybrid breeding, e.g. through involving farmers in the process of choosing the types of parental lines (e.g. as part of stages 3 and 7), these obstacles may make it difficult to bring a PPB strategy into practice for HTPS breeding. As an alternative, farmer variety selection (PVS) may be considered as a lighter version of PPB (Ceccarelli and Grando, 2020) which is much easier to organise. According to this model, farmers' participation begins during variety testing (stage 5). An example of PVS in potato breeding is the role of so-called 'farmer breeders' in the Dutch potato sector. These farmers, sometimes called 'hobby breeders', are often older farmers with a lot of experience in potato cultivation. They identify and select potentially promising potato varieties that were bred by e.g. trading houses (Almekinders *et al.*, 2014). Similarly, Halewood *et al.* (2007) sketch different modes of cooperation between smallholders and private companies in the breeding cycle. It demonstrates that PPB-elements may be combined with commercial breeding and that several versions of PPB distinguished by the level of the involvement of different stakeholders, are possible (see also Chapter 10).

9.7.2 Hybrid potato breeding as a common good

The possible rise of hybrid breeding is expected to lead to a changing playing field in the potato sector. New players rooted in vegetable breeding are entering the potato sector and they tend to operate on the basis of business models that require a stronger adherence to established property rights than conventional potato companies do. As a consequence, HTPS may become less available for smallholders. Therefore, taking into account the diversity of local needs through PPB and PVS is not enough, we also need to ensure that HTPS technology and the resulting varieties and parental lines remain available to smallholder and/or public research institutions in LMICs. Currently, the technology is mainly in the hands of private or cooperative Western-based companies and not publicly available. As far as we know no public research institutes are currently developing inbred parental potato lines.

During an international workshop on hybrid breeding with participants from diverse LMICs (Swart and Stemerding, 2020), it was concluded that HTPS technology was a promising technology for African smallholders, but that new breeding platforms and participation of a wider set of stakeholders were needed in the African context. In an opinion paper in Nature Plants (Beumer and Stemerding, 2021) it is argued that the technology may contribute to SDGs but 'to realise this promise, it is crucial that hybrid diploid breeding be made widely accessible' (p. 1530). The authors observe that this is currently not the case because the inbred parental lines, which are absolutely needed to breed hybrid varieties, are kept in secrecy by companies to protect their big investments as they are bound by economic constraints. Their space for making available the underlying genetics for smallholders and public research institutes is therefore limited.

However, the development of hybrid breeding technology is also based on public (academic and local) knowledge and shared genetic resources (Beumer *et al.*, 2021). Because of its potentially large public significance and impact, it may be considered as a common good: a resource that should be accessible to all members of a society or a group that are dependent on or have an interest for it (see e.g. https://iasc-commons.org/about-commons/). To deal with these contrasting

aspects, Beumer and colleagues plea for making hybrid technology better available to LMICs by setting up breeding consortia for hybrid potatoes directed to the needs of small farmers in the informal system (Beumer and Stemerding, 2021; Beumer *et al.*, 2021). The basic idea is that breeding companies should make their parental lines available to public breeding institutes exclusively working for smallholder farmers, while they may still apply their intellectual property rights to farmers and breeders that do not belong to the informal system.

Clearly, establishing such a platform transcends the capacities of individual companies that have to operate in a global and highly competitive environment. An international, collective effort to achieve a level playing field is therefore needed between breeding companies, governmental institutions, NGOs, charities, and local smallholder representatives (see also NFP, 2021). While PBS and PVS focus on possible negotiation strategies of individual companies with their stakeholders, the concept of benefit sharing requires cooperation between companies and institutional parties and involves collective decision-making. Recognising the common good character of hybrid breeding, such an initiative should thus distinguish between different partners from the formal and informal systems with regard to breeding rights and accessibility of the hybrid varieties. During the 2020 conference on hybrid potato breeding (Stemerding *et al.*, 2021) it was stressed that there is already a long tradition of cooperation and exchange of knowledge, supported by governmental and sector-wide institutions, especially in the Netherlands. It is precisely this tradition that has the potential to institutionalise corporate social responsibility at the sector level in an international context, in order to give stakeholders a significant voice at multiple levels over the value chain with respect to hybrid breeding.

9.8 Conclusions

In this chapter, we have considered potato breeding and especially hybrid breeding in the context of SDGs and LMICs from the perspective of corporate social responsibility and responsible research and innovation. Companies involved in hybrid potato breeding stress the role of this technology in the context of the SDGs. However, our interviews indicated that the way and the pace with which new hybrid varieties will reach smallholders will not differ much from the current situation. To deal with the SDG-challenges we elaborated on the concept of CSR and RRI in the context of SDGs, integrating concepts from PPB, PVS and benefit sharing. Recognising the common good character of hybrid breeding we argue, in line with the conclusion of the 2020 conference on hybrid potatoes, for an integrated collective chain approach, requiring the support from supranational institutions, international funding organisations, charities and companies. Such a strategy should not only focus on breeding issues but also on social and institutional aspects including poverty, inequality and injustice.

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Ethics approval

This research has been approved by the Human Research Ethics Committee of TU Delft. All interviewees have given their informed consent to participation in the study and use of the results.

References

Almekinders, C.J.M., 2011. The joint development of JM-12.7: a technographic description of the making of a bean variety. NJAS – Wageningen Journal of Life Sciences 57: 207-216. https://doi.org/10.1016/j.njas.2010.11.007

Almekinders, C.J.M., Mertens, L., Van Loon, J.P. and Lammerts van Bueren, E.T., 2014. Potato breeding in the Netherlands: a successful participatory model with collaboration between farmers and commercial breeders. Food Security 6: 515-524. https://doi.org/10.1007/s12571-014-0369-x

Almekinders, C.J.M., Walsh, S, Jacobsen, K.S., Andrade-Piedra, J.L., McEwan, M.A., De Haan, S., Kumar, L. and Staver, C., 2019. Why interventions in the seed systems of root, tuber and banana crops do not reach their full potential, Food Security 11: 23-42. https://doi.org/10.1007/s12571-018-0874-4

Beumer, K. and Stemerding, D., 2021. A breeding consortium to realize the potential of hybrid diploid potato for food security. Nature Plants 7: 1530-1532. https://doi.org/10.1038/s41477-021-01035-4

Beumer, K., Stemerding, D. and Swart, J.A.A., 2021. Innovation and the commons: lessons from the governance of genetic resources in potato breeding. Agricultural and Human Values 38: 525-539. https://doi.org/10.1007/s10460-020-10169-8

Ceccarelli, S. and Grando S., 2020. Participatory plant breeding: who did it, who does it and where? Experimental Agriculture 56: 1-11. https://doi.org/10.1017/S0014479719000127

Chakrabarti, S., 2014. The formal-informal dichotomy: revisiting the debate on the agriculture-industry linkage. The Economic and Labour Relations Review 25(1): 154-178. https://doi.org/10.1177%2F1035304613517988

De Vries, M., Ter Maat, M. and Lindhout, P., 2016. The potential of hybrid potato for East Africa. Open Agriculture 1: 151-156. https://doi.org/10.1515/opag-2016-0020https://doi.org/10.1515/opag-2016-0020

Dreyer, M., Chefneux, L., Goldberg, A., Von Heimburg, J., Patrignani, N., Schofield, M. and Shilling, C., 2017. Responsible innovation: a complementary view from industry with proposals for bridging different perspectives. Sustainability 9(10): 1719. http://www.mdpi.com/2071-1050/9/10/1719

European Commission (EC), 2011. Communication from The Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A renewed

EU strategy 2011-14 for Corporate Social Responsibility. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52011DC0681.

European Commission (EC), 2014. Rome declaration on responsible research and innovation in Europe. Available at: https://tinyurl.com/45f4zjt7.

Givel, M. 2007. Motivation of chemical industry social responsibility through responsible care. Health Policy 81(1): 85-92. https://doi.org/10.1016/j.healthpol.2006.05.015

Gurzawska, A., Mäkinen, M. and Brey, P., 2017. Implementation of responsible research and innovation (RRI) practices in industry: providing the right incentives. Sustainability 9(10): 1759. https://doi.org/10.3390/su9101759

Halewood, M., Deupmann, P., Sthapit, B.R., Vernooy, R. and Ceccarelli, S., 2007. Participatory plant breeding to promote farmers' rights. Biodiversity International, Rome, Italy. Available at: https://tinyurl.com/2p9mre32.

Imaz, O. and Eizagirre, A., 2020. Responsible innovation for Sustainable Development Goals in business: an agenda for cooperative firms. Sustainability 12(17): 6948. https://doi.org/10.3390/su12176948

International Labour Organization (ILO), 2018. More than 60 per cent of the world's employed population are in the informal economy. ILO, Geneva, Switzerland. Available at: https://tinyurl.com/mpbwybdu.

King, A.A. and Lenox, M.J., 2000. Industry self-regulation without sanctions: the chemical industry's responsible care program. The Academy of Management Journal 43(4): 698-716. https://doi.org/10.2307/1556362

Kloppenburg, J.R., 2004. First the seeds. The political economy of plant biotechnology, 1492-2000. 2nd edition. The University of Wisconsin Press, Madison, WI, USA, 468 pp.

Lammerts van Bueren, E.T., Struik P.C., Van Eekeren, N. and Nuijten, E., 2018. Towards resilience through systems-based plant breeding. A review. Agronomy for Sustainable Development 38: 42. https://doi.org/10.1007/s13593-018-0522-6

Li, J., Lammerts van Bueren, E.T., Huang, K., Qin, L. and Song Y., 2013. The potential of participatory hybrid breeding. International Journal of Agricultural Sustainability 11(3): 234-251. https://doi.org/10.1080/14735903.2012.728050

Lindhout, P., De Vries, M., Ter Maat, M. Ying, S., Viquez-Zamora, M. and Van Heusden S., 2017. Hybrid potato breeding for improved varieties. In: Wang-Pruski, G. (ed.) Achieving sustainable cultivation in potatoes. Volume 1. Burleigh Dodds Science Publishing, Cambridge, United Kingdom. https://doi.org/10.19103/AS.2016.0016.04

Louwaars, N.P. and De Boef, W.S., 2012. Integrated seed sector development in Africa: a conceptual framework for creating coherence between practices, programs, and policies. Journal of Crop Improvement 26(1): 39-59. https://doi.org/10.1080/15427528.2011.611277

Ludwig, D., Blok, V., Garnier, M., Macnaghten, P. and Pols, A., 2021. What's wrong with global challenges? Journal of Responsible Innovation 9(1): 6-27. https://doi.org/10.1080/23299460.2021.2000130

Netherlands Food Partnership (NFP), 2021. Impact coalition hybrid true potato seed. scoping report. NFP, The Hague, the Netherlands. Available at: https://tinyurl.com/mx4znad2.

Nyéléni, 2007. Declaration of Nyéléni. Available at: https://nyeleni.org/en/declaration-of-nyeleni/.

Porter, M.E. and Kramer, M.R., 2006. Strategy and society: the link between competitive advantage and corporate social responsibility. Harvard Business Review 84(12): 78-92. Available at: https://tinyurl.com/4e52bam3.

Rittel, H. and Webber, M. 1973. Dilemmas in a general theory of planning. Policy Sciences 4(2): 155-169. https://doi.org/10.1007/BF01405730

Stemerding, D., Swart, J.A.A., Lindhout, P. and Jacobs, J., 2021. Potato futures: impact of hybrid varieties. Report of an online conference held in Doorn, the Netherlands, on November 30, 2020. 25 pp. NFP, The Hague, the Netherlands. Available at: https://tinyurl.com/mrx4wzjn.

Stilgoe, J., Owen, R. and Macnaghten, P., 2013. Developing a framework for responsible innovation. Research Policy 42(9): 1568-1580. https://doi.org/10.1016/j.respol.2013.05.008

Swart, J.A.A. and Stemerding, D., 2020. Opportunities and challenges for hybrid potatoes in East Africa. Report of a workshop held on 13-14 June 2019, Ghent, Belgium. Available at: https://tinyurl.com/3barv2ka.

Tushman, M.L., 1977. Special boundary roles in the innovation process. Administrative Science Quarterly 22(4): 587-605. https://doi.org/10.2307/2392402

United Nations – Department of Economic and Social Affairs (UN-DESA), n.y. Goal 2. United Nations, New York, NY, USA. Available at: https://sdgs.un.org/goals/goal2.

United Nations Industrial Development Organizations (UNIDO), n.y. What is CSR? United Nations, New York, NY, USA. Available at: https://tinyurl.com/mss665vx.

Van de Poel, I., Asveld, L., Flipse, S., Klaassen, P., Kwee, Z., Maia, M., Mantovani, E., Nathan, C., Porcari, A. and Yaghmaei, E., 2020. Learning to do responsible innovation in industry: six lessons. Journal of Responsible Innovation 7(3): 697-707. https://doi.org/10.1080/23299460.2020.1791506

Van de Poel, I., Asveld, L., Flipse, S., Klaassen, P., Scholten, V. and Yaghmaei, E., 2017. Company strategies for responsible research and innovation (RRI): a conceptual model. Sustainability 9(11): 2045. https://doi.org/10.3390/su9112045

Voegtlin, C., Scherer, A.G., Stahl, G.K. and Hawn, O., 2022. Grand societal challenges and responsible innovation. Journal of Management Studies 59(1): 1-28. https://doi.org/https://doi.org/10.1111/joms.12785.

Von Schomberg, R., 2013. A vision of responsible innovation. In: Owen, R., Bessant, J. and Heintz, M. (eds) Responsible innovation. John Wiley and Sons, Chichester, United Kingdom, pp. 51-74. https://doi.org/10.1002/9781118551424