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Facing failures: A framework for understanding and identifying failure in international development

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Abstract

Failures happen everywhere, and international development is no exception. However, an explicit conversation on failure and how to identify it is absent in the development studies literature. There are other scholarly domains in which failure is explicitly discussed, and the conversation about unintended effects in development alludes to the topic of failure, but these conversations have remained disconnected. This paper aims to connect these two bodies of knowledge to enable a more explicit and concise conversation about failure in international development. It does so by reviewing three bodies of literature that explicitly deal with failure in various forms and integrating them with the conversation on unintended consequences in international development. The result of this integration is a framework that can guide both development researchers and practitioners in assessing different types of failures and distinguishing appropriate (combinations of) failure identification strategies.

1. Introduction

There seems to be an increasing awareness of and readiness to discuss failures in international development. Recently, this has been illustrated by the participation of several development organisations, including USAID (Haugh, 2015) and the Overseas Development Institute (Pasanen, 2020), in "Fail Festivals" in which practitioners gather to explicitly share, discuss, and learn from their failures. While this conversation about failures in development practice is growing, there is a surprising silence in the development studies literature about how to engage systematically with failure for organisational learning.

At the same time, there is already a more developed body of literature on organisational learning and failure in general. Specifically, Cannon & Edmondson (2005) identify three processes that are critical for organisations to learn from failures: identifying failure, analysing failure, and deliberate experimentation. The latter two are increasingly addressed in the international development sector, for example through the previously mentioned Fail Festivals, the increasing use of innovation labs (Bloom & Faulkner, 2016; McGann, Blomkamp & Lewis, 2018), and experimentation in program design and monitoring and evaluation (M&E) (Banerjee & Duflo, 2009; Pritchett, Samji & Hammer, 2013; Rodrik, 2008). The first process, identifying failure, however, remains implicit in most narratives about failure in development. This is striking as the identification of failure is crucial for the other two processes, especially if one aims to identify and deal with failures before they escalate into large-scale crises. Therefore, this paper seeks to address the question of how the existing scholarly perspectives on failure and its identification could be integrated into ongoing discussions in development studies, in order to enable a more explicit and concise conversation about failures in international development.

Despite the absence of an explicit academic discussion of failure and its identification in international development, there is an ongoing conversation about the identification and evaluation of unintended effects of development interventions.[1] Jabeen (2018) defines unintended effects as "effects of people's actions other than they have intended." Specifically, in international development, these are the effects that fall outside the intentions of an intervention. She has offered a typology of unintended effects, based on four aspects of classification: *knowability*, *value*, *distribution*, and *temporality*. Failures, defined as "deviations from a desired outcome" (Edmondson, 2012), can then be understood as those unintended effects that have a negative value attached to them. However, despite this implicit link, the literature on unintended effects has remained largely disconnected from the conversation about failure.

This paper aims to connect these two conversations. It does so by integrating ideas from explicit discussions on failure that are unrelated to the international development sector with the implicit discussion of failure in development studies that is represented by the literature on unintended effects. Hence, this paper will draw on three bodies of literature that explicitly deal with failure in various forms to explore existing understandings of and identification strategies for failure. Subsequently, it will build on the typology for unintended effects by Jabeen (2018) to build a bridge between those insights and development studies. In doing so, it provides a framework that can help development actors assess and broaden their failure identification strategies. Simultaneously, it illustrates the diversity of failure and the importance of including that diversity in the conversation about failure in development.

The three bodies of literature that are reviewed in this paper were identified using Edmondson's (2012) Process Knowledge Spectrum. The Process Knowledge Spectrum categorises organisational processes based on the level of knowledge and uncertainty about how to produce desired results. According to Edmondson, the type and role of failures in organisational learning differ depending on where organisational processes fall on this spectrum. The three bodies of literature that were reviewed focus on 1) production and manufacturing, 2) high-risk socio-technical processes, and 3) research and development

[1] See for example the 2018 *Evaluation and Program Planning* Special Issue on unintended effects in international cooperation, Morell (2010) and Zwart (2015).

(R&D). These are associated with different locations on the Process Knowledge Spectrum and, hence, cover a range of processes and failures. The four aspects of classification from Jabeen's (2018) typology are then used to further unravel these three different understandings of failure and their implications for development studies.

The paper continues as follows. Section 2 highlights the two conceptual contributions on which this paper builds: the idea of the Process Knowledge Spectrum as introduced by Edmondson (2012) and the typology of unintended effects by Jabeen (2018). Section 3 describes the methods and materials used. Section 4 comprises an analysis of the three selected bodies of literature and their understanding of failure. Section 5 connects the typology of unintended effects by Jabeen to the insights from the reviewed literature and presents a framework for understanding and identifying failure in development practice. The paper concludes with the implications of the findings for research and practice.

2. Conceptual framework

This paper aims to connect insights from explicit conversations about failure and its identification to the underdeveloped discussion on failure in development studies. This section discusses the two contributions on which this connection is based: the work by Edmondson (2012) on the Process Knowledge Spectrum, and Jabeen's (2018) typology of unintended effects.

2.1 Failure and the Process Knowledge Spectrum

According to Edmondson (2012), organisational processes can be placed on a Process Knowledge Spectrum. The term *process knowledge* refers to the available knowledge about how to produce a desired result. On the far-left side of the spectrum are routine processes, which are operations with little uncertainty because knowledge about how to produce a desired result is tested and processes are (mostly) constant. Innovation processes are situated at the other side of the spectrum with high levels of uncertainty about pathways to desired results. Located in the middle of the spectrum are complex processes which are characterised by a reasonable level of available knowledge and mature processes, but at the same time are faced with uncertainty about crucial aspects of those processes. The three bodies of literature that will be reviewed in this article reflect these three ideal types: production and manufacturing (routine processes), high-risk socio-technical processes (complex processes), and R&D (innovation processes).

Since it concerns a spectrum, these are not exclusive categories. At the same time, the location on the spectrum of the operations that an organisation (predominantly) engages in has implications for organisational learning and the type and role of failures in that process (Edmondson, 2012). By basing the selection of literature on the Process Knowledge Spectrum, this paper draws on three scholarly domains that have distinct relationships with failure. This serves to explore a range of strategies for the identification of failure.

2.2 Evaluating unintended effects

The importance of unintended effects, both positive and negative, seems to be widely acknowledged in the development evaluation community. This is reflected by the fact that specific attention to unintended effects is listed in the OECD Development Assistance Committee (DAC) guidelines for the evaluation of development interventions, which was published in the early 90s, and the various scholarly discussions on the topic (for an overview, see Jabeen 2016). However, the study of unintended effects[2] has been characterised by unclear terminology and categorisation (Jabeen, 2016; Jabeen, 2018; Koch & Schulpen, 2018; Zwart, 2015). Jabeen (2018) has attempted to improve this by proposing a typology of unintended effects, based on four aspects of classification:

1) *knowability*: whether the unintended effects are anticipated or unanticipated. If they are unanticipated, another subdivision is made between those effects that are theoretically *foreseeable* (i.e. with the right efforts they could be anticipated) or *unforeseeable* (i.e. even with all the knowledge in the world, these could not be foreseen);
2) *value*: whether they are positive, negative or neutral effects;
3) *distribution*: how the effects are distributed (i.e. are only (non-) participants affected, or is the whole system affected?); and
4) *temporality*: when the unintended effects occur (i.e. simultaneously with the intervention or later in time).

Given this typology, failures, defined as "deviations from a desired outcome" (Edmondson, 2012), can be categorised as those unintended effects that have a negative effect, while the other three aspects of classification might vary. Jabeen argues that the various types of unintended effects, specifically unintended effects with different levels of *knowability*, require different strategies to identify and learn from them. Hence, although Jabeen does not explicitly discuss failures, her typology implicitly touches upon the identification of failure in development.

[2] The words "effects", "consequences", "outcomes" and "impacts" are often used interchangeably in relation to unintended effects (Koch & Schulpen, 2018). There is an ongoing conversation about the preferred term, but that is beyond the scope of this paper.

3. Methods & materials

As mentioned above, this paper is based on a literature review of three bodies of literature, which were selected based on the three ideal types of the Process Knowledge Spectrum and the availability of relevant literature. An initial selection of academic articles was identified through a literature search in Google Scholar, using combinations of the terms "fail" and "failure" and the respective sectors. The selection was then narrowed down by screening the title and abstract to verify that their use of the concept of failure was in line with that of this paper. After this initial selection, the selected literature was complemented by bibliography searches, snowballing, and literature already known to the author. The final selection comprised a total of 32 resources, which were a mix of academic articles and books.[3] Hence, the descriptions of the bodies of literature in this paper are not extensive reviews but are taken to reflect the sectors' general understanding of and approach to identifying failure.

The literature was then analysed on three dimensions: 1) the *conceptualisation* of failure, 2) strategies for the *identification* of failure, and 3) *classifications* of failure. These three dimensions were selected because they shed light on how failure is understood and the various ways in which it can be identified. The analysis was done by first identifying these three dimensions for each source. Subsequently, they were compared and summarised to reflect the different bodies of literature's discussion of failure. The four aspects of classification that are at the core of Jabeen's (2018) typology of unintended effects were then used to further unravel the distinct understandings of failure and clarify their relation to development practice.

4. Results

This section presents the review of the three bodies of literature that are associated with the three ideal types of Edmondson's (2012) Process Knowledge Spectrum: routine, complex and innovation processes. Each body of literature is discussed separately, focussing on their conceptualisation, identification, and classifications of failure.

4.1 Routine processes

Production and manufacturing processes are characterised by activities that are standardised and repetitive. Generally, the process knowledge about routine processes has been developed

[3] There were 11 resources related to production & manufacturing, 9 related to complex socio-technical processes, and 12 related to R&D.

extensively, resulting in a deep understanding of the process' components and their interactions. Because these routine processes are often understood in detail, they are also relatively predictable.

Much of the literature discussing routine processes originates from management and logistical studies and was influenced by process engineering and scientific management traditions. Both these traditions are associated with a focus on identifying optimal organisational processes (Kühl, 2019).

4.1.1 Conceptualisation of failure

There is a clear focus on optimisation and control in the reviewed literature on failures in production and manufacturing. This focus follows from the routine nature of production processes, which makes that most steps in the process are standardised and that stability is relatively high (Balakrishnan, Bowen & Eckstein, 2008; Edmondson, 2012; Sitkin, Sutcliffe & Schroeder, 1994). Given the stability of routine processes and the economic pressure that underlies many production and manufacturing processes, efficiency and continuity have been central in the academic literature seeking to improve this type of processes.

Hence, a failure in production and manufacturing has a negative connotation because it represents an "error" in a process that is believed to be controllable. It is an interruption of an otherwise efficient process (e.g. a machine breakdown), or an event that results in lower quality end products (e.g. a mistake by an employee) (Ahmad, Badwelan, Ghaleb, Qanhan, Sharaf, Alatefi & Moohialdin, 2018; Neiger, Rotaru & Churilov, 2009). Illustrative of this conceptualisation of failure as a negative disruption of an otherwise stable process is the use of the Mean Time Between Failure (MTBF) indicator to determine production stability (Ahmad et al., 2018). The MTBF can be used 1) to predict the timing of a failure, which could, for example, inform maintenance planning, and 2) to measure variability within the production process; the higher the MTBF, the more stable the process is.

In line with the understanding of failures as adverse events that impede production efficiency and stability, failure identification is often discussed in relation to quality control processes. Namely, quality control should ensure stability and control over the production process and products. Total Quality Management (TQM), a management strategy with a focus on continuous improvement, minimised errors and customer satisfaction (Sitkin, Sutcliffe & Schroeder, 1994), is an example of a quality control strategy that simultaneously monitors and addresses failures. Similarly, Six Sigma, a data-driven approach aiming to achieve a maximum of 3.4 defects per million opportunities (Valles, Sanchez, Noriega & Nuñez, 2009), focuses on minimising failures in routine processes. This strong link between failure identification and quality control in the reviewed literature and the focus on optimising processes and stability, illustrate two dimensions of the conceptualisation of failure in the production and manufacturing literature. Firstly, failures are to be prevented because they harm production stability and quality. Secondly, failures are preventable when the process is monitored sufficiently because of the predictable nature of the routine processes.

4.1.2 Identification of failure

The high certainty and low variability in routine processes means that both the processes and the causal mechanisms within and between those processes are relatively stable and understood. The high certainty in these processes in combination with the fact that the routine nature of production creates large-N datasets makes that most of the approaches to identifying failure in production processes can rely heavily on quantitative, and particularly statistical monitoring strategies, to identify failures.

These quantitative monitoring strategies are often preceded by the mapping of sources of (potential) failure. Different risk sources are monitored and often prioritised according to their "criticality" (Ahmad et al., 2018; Neiger, Rotaru & Churilov, 2009). The criticality of a potential failure can be quantified through (a variation of) the following formula: *Severity (S) x Occurrence x Detection likelihood (D)* (Geramian, Mehregan, Mokhtarzadeh & Hemmati, 2017). Those risks that are considered critical, either because they are too hazardous or because they thwart efficiency, become the focus of efforts to reduce the occurrence of failures. Efforts to reduce specific types of failure in production and manufacturing often take the shape of projects handled by specific problem-solving teams based on statistical analyses (Kwak & Anbari, 2006; Sitkin, Sutcliffe & Schroeder, 1994).

The mapping and quantified prioritisation of risk sources, together with the reliance on statistical approaches for identifying failures, reveals an underlying understanding of the nature and knowability of failures that is implicit in the reviewed literature. That is, it is assumed that failures and their likelihood and impact can be known and quantified.

Table 1 lists those methods of identifying failure that were prominently discussed throughout the identified literature. All three of these approaches are instrumental in nature; they focus on instruments (e.g. quantitative models or team structures) for identifying failures. Some of the approaches are also characterised by heavy accreditation and training structures, emphasising this instrumental nature.

Table 1. Approaches to identifying failure in production and manufacturing

Name	Description	Main steps and tools used for identifying failure	Example literature
Total Quality Management (TQM)	A management approach focussing on customer satisfaction and improving quality, viewing organisations as total systems.	TQM often relies on statistical methods and problem-solving teams to both monitor performance and to identify high impact points for improvement.	*Application*: Agus & Hassan, 2011; Sitkin & Stickel, 1996 *Theory*: Hackman & Wageman, 1995; Sitkin, Sutcliffe & Schroeder, 1994
Six Sigma	A data-driven management approach for reducing defects, intending to achieve 3.4 defects per million opportunities. There is a strong focus on reducing variation.	Six Sigma is focussed on identifying defects using statistical process control (SPC), FMEA, and other statistical methods. These statistical approaches are combined with problem-solving teams that are set up to manage improvement.	*Application:* Schroeder, Linderman, Liedtke & Choo, 2008; Valles, Sanchez, Noriega & Nuñez, 2009 *Theory:* Kwak & Anbari, 2006; Schroeder et al., 2008
Risk identification and analysis	A range of approaches, some of which are also incorporated in the two other approaches. All share a focus on identifying potential risks within a process, and subsequently, identifying those with the highest potential impact.	Identifying risks and assessing which will have the most significant impact, often through quantification of those risks, for example, with FMEA. Subsequently, an approach for minimising those risks is established, together with a way to monitor them	*Application:* Balakrishnan, Bowen & Eckstein, 2008; Neiger, Rotaru & Churilov, 2009 *Theory:* Balakrishnan, Bowen & Eckstein, 2008

4.1.3 Classification of failure

Several ways of classifying failures appear in the reviewed literature. The first one is based on a failure's level of criticality. Failures with a high criticality score are usually prioritised and might require stricter monitoring. A second strategy for categorisation of failures is their source or the location in the production process from which the failure originates. For example, Ahmad et al. (2018) distinguish between failures with mechanical, electrical, material, production organisation and planning as sources of failures. Others, like

Balakrishnan, Bowen & Eckstein (2008) distinguish between failures that originate from within the organisation and those that are external to the organisation.

Lastly, the predictability of a failure has been suggested as a classification strategy (Balakrishnan, Bowen & Eckstein, 2008). Regardless of the high certainty in production processes, some uncertainty and unpredictability always remain; especially failures that originate from outside of an organisation are difficult to predict. However, these unpredictable failures are not included in the scope of these standardised monitoring strategies, and hence, the literature reviewed gives little guidance on how to identify them (Balakrishnan, Bowen & Eckstein, 2008).

4.1.4 Conclusion

The conceptualisation and categorisations of failures in the literature on production and manufacturing illustrate that failures are seen as knowable and understandable events that can be predicted and prevented with the right instruments. This, in combination with a reliance on statistical analysis and predetermined quantified indicators, hints to a focus on anticipated failures.

4.2 Complex processes

Since the second half of the 20th century, scholars, particularly in the social sciences, have explored how organisations and their members deal with failure in complex processes. These studies were sparked by several accidents caused by upcoming technologies, like nuclear powerplants and space travel, that occurred during that time (Bierly III & Spender, 1995; Rijpma, 1997).

The processes behind these technologies can be described as complex socio-technical processes because they encompass multiple and interacting social and technical dimensions. They are also strongly characterised by their uncertainty and the interconnectedness of different sub-processes. That is, while the individual aspects of such process tend to be reasonably understood, the novel and complex interactions between these aspects and between the aspects and their environment often result in unpredictable effects (Edmondson, 2012; Leveson, Dulac, Marais & Carroll, 2009). In some cases, these uncertain outcomes may result in learning through an improved understanding of the causal dynamics within the system. However, small failures in highly complex settings might also quickly escalate into immense challenges that are hard to understand and control (Edmondson, 2012).

4.2.1 Conceptualisation of failure

The literature that was reviewed focusses on socio-technical processes that have "great productive as well as destructive powers" (LaPorte & Consolini, 1991). The fact that these processes can have disastrous effects makes that failures are inherently dangerous and are to be avoided. As a result, the discussion of failures in the literature is often linked with discussions about "safety" and "reliability" (Leveson et al., 2009).

Previous accidents with complex socio-technical processes, however, have illustrated that no organisation can be entirely failure-free (LaPorte & Consolini, 1991). In many cases, even a small mistake can destabilise a system and create turmoil. This is especially true for complex processes that are characterised by "tight-coupling". A system is tightly coupled when the aspects of that system are highly and strictly dependent on each other. In addition, within a tightly coupled system, one single aspect of a system might serve multiple purposes. As a result, tightly coupled systems allow for little variation in the process because of high sensitivity to delays and changing, novel environments (Perrow, 2011; Rijpma, 1997).

In a way, within these uncertain and complex socio-technical processes, accidents are bound to happen. Hence, there is an apparent tension in the literature's discussion of failures. On the one hand, failures are to be avoided because of their potential impacts. On the other hand, the complexity of these operations makes that risks are difficult to identify and that once a failure occurs, it can quickly escalate and destabilise an entire system.

This tension has led to the development of two theories on failures in complex socio-technical environments. The first theory, Normal Accident Theory (NAT), is based on the work of Charles Perrow. In his book *Normal Accidents,* Perrow (2011) concludes that because of this increasing complexity of our socio-technical processes, accidents are eventually inevitable and will continue to increase with the use of these technologies. The second theory, High-Reliability Theory (HRT), can be seen as a critique on NAT, arguing that many organisations that perform complex operations are characterised by high-reliability, instead of the high accident rates that NAT predicts (Bierly III & Spender, 1995; Leveson et al., 2009). HRT attests that these high-reliability organisations employ organisational strategies that can overcome the difficulties of complex socio-technical processes (Rijpma, 1997).

While these two theories have often been contrasted, their general conceptualisation of failures is similar. That is, failures are seen as events that have a substantial negative impact, often in terms of safety. In addition, both theories recognise the difficulties of identifying and preventing failures in complex socio-technical processes due to the uncertainty embedded in those operations. The complexity of these processes also makes that identifying the underlying causal mechanisms of a failure is challenging, if not impossible.

4.2.2. Identification of failure

Since failures in complex socio-technical processes can quickly escalate, most of the literature reviewed describes approaches to either 1) prevent failures, or 2) recognise and respond to failures as soon as possible (Rijpma, 1997; Leveson et al., 2009).

NAT, because it attests that accidents are mostly unavoidable, rarely explicitly discusses the prevention of failures. Regarding the identification and response to failures, NAT primarily stresses the importance of establishing processes that allow for rapid response in case of a failure. However, NAT points to a tension between centralisation, which allows for fast, structured decision making, and the need for decentralisation in order to reduce the tight-coupling within a system. Namely, decentralisation could make a system less vulnerable to the escalation of minor errors into significant failures (Rijpma, 1997). According to NAT, the tension between centralisation and decentralisation is one of the primary reasons that accidents in complex socio-technical processes are unavoidable and unpredictable.

While NAT does not provide clear insights for the identification of failure, HRT proposes several organisational practices that support the identification of potential failures and prevent significant failures. These organisational practices are divided into (a variation of these) five elements (Cooke & Rohleder, 2006; Ford, 2018; Leveson et al., 2009; Rijpma, 1997):

1. high management priority on safety and reliability;
2. backup for and duplications of critical aspects of the process;
3. decentralised organisation structure with centralised goals and standards;
4. open culture regarding learning, trial and error, and training through crisis simulation, and;
5. diversity in theoretical perspectives among its experts to avoid "blind spots."

Thus, there is a clear difference in opinion between the two theories on whether and how failures can be prevented and identified. Nevertheless, both theories acknowledge the imperfect knowledge about the technical processes and the uncertainty inherent in social systems. In addition, both theories stress the importance of organisational factors in the identification of failures. However, HRT focusses on organisational practices that create an environment in which failures are recognised and discussed before they escalate. NAT, on the other hand, seems to stress the importance of organisational structures that allow for quick responses to failures and limit the impact of a failure. Table 2 summarises these two theories and their implications for identifying failure.

Table 2. Approaches to identifying failure in high-risk socio-technical processes

Name	**Description**	**Main steps and tools used for identifying failure**	**Example literature**
High Reliability Theory	A management approach focusing on improving reliability, with a strong focus on preventing failures.	Identifying failures through open and direct communications about potential failures, relying on the expertise of employees and diverging theoretical perspectives to avoid "blind spots". Procedures are standardised, but flexibility is allowed in crisis and novel situations. Extensive practice and simulation aim to ensure rapid response, and learning from near misses is a continuous practice.	Application: Bierly III & Spender, 1995; Hutchins, 1996; Sagan, 1995 *Theory:* Ford, 2018; LaPorte & Consolini, 1991; Rijpma, 1997
Normal Accident Theory	Theory describing the inevitability of accidents in complex processes. The focus is primarily on reactive practices once a failure has occurred.	Centralisation of decision-making ensures that failures are recognised and responded to before they affect the whole organisation. Simplifying operations could improve the detectability of failures, although this might not always be possible due to technological limitations.	Application: Perrow, 2011; Sagan, 1995 *Theory:* Perrow, 2011; Rijpma, 1997

4.2.3 Classification of failure

The literature on high-risk socio-technical processes reveals two main ways of classifying failures: impact size, and the source of the failure. The classification based on the impact size distinguishes between failures that have no impact, minor impact, or large impact. Failures with no significant impact are referred to as "near misses". These near misses are especially useful for learning purposes because they provide information about risk factors and points of improvement without safety implications (Cooke & Rohleder, 2006; Rijpma, 1997). Failures that only affect a part of the process are often referred to as "incidents" or "errors". The terms "accident" or "system failure" are used for failures that disrupt a whole process or organisation (Cooke & Rohleder, 2006; LaPorte & Consolini, 1991; Leveson et al., 2009). Failures that have incredibly tragic consequence, like loss of life, are sometimes categorized separately as "disasters" (Cooke & Rohleder, 2006).

The second classification strategy focusses on the source of a failure. These sources of failure can be errors in the design of the process, operational errors, the encounter of novel circumstances, among others (Edmondson, 2012; Leveson et al., 2009). These failures could potentially be prevented in the future when analysed in detail. Hence, failures occurring due to individually identifiable processes might enable the redesign of the process. However, failures can also be caused by "dysfunctional interactive complexity." This occurs when each aspect of a process functions correctly, but the interaction between these aspects is dysfunctional (Leveson et al., 2009; Rijpma, 1997). The failures that result from this dysfunctional interactive complexity are much harder to understand or prevent. These failures might call for improved resilience instead of precise alterations to the process design.

4.2.4 Conclusion

The categorisations illustrate that the literature on complex socio-technical processes discusses failures as negative events that, depending on their cause, can be foreseeable or not. In addition, the use of terms like "accident" and "disasters" hints to an understanding that failure does not have to be caused by culpable actions by individuals.

4.3 Innovation processes

Innovation is often seen as one of the key priorities for organisations in today's competitive and fast-changing markets (Iske, 2019; van der Panne, van Beers & Kleinknecht, 2003). As a result, these innovation processes have been studied in a wide range of business and management studies. In large organisations, innovation is often explicitly separated from other processes through the establishment of R&D units. In smaller organisations, like start-ups, R&D is often more integrated into the organisation's day-to-day activities. Either way, experimentation and exploration are central in these R&D processes (Khanna, Guler & Nerkar, 2016; Magazzini, Pammolli, Riccaboni, 2012; Tahirsylaj, 2012). Stability of the process is less of a priority due to the lack of a blueprint for the innovation process; there is little process knowledge because of the inherent novelty of innovation processes (Edmondson, 2012).

4.3.1 Conceptualisation of failure

Many innovation projects are not guided by strict specifications but are characterised by broad and ambitious goals (Elmquist & Le Masson, 2009). Due to the lack of a clear road map to success in innovation processes, trial and error is a key strategy to explore and deal with novelty and insecurity. As a result, R&D units tend to work on multiple potential successful projects at the same time, and high failure rates are often not only acceptable but to be expected (Iske, 2019; Reis, 2011).

Since R&D units are designed for experimentation, failure is to be expected. As a result, organisations aim to minimise the effects of failed experiments on the wider organisation. Failures are described as essential for the innovation process because as long as the intended goal has not been reached, failures are one of the most important sources of information about which avenues to pursue. Failures are therefore predominantly described as something to learn from. Nevertheless, unidentified failures can result in a waste of resources when hopeless research avenues continue to be pursued.

It is this combination of the value of failures in innovation processes and the need to carefully manage limited resources that have led to the development of the concept of "Intelligent Fast Failures" (IFF) (Matson, 1991; Tahirsylaj, 2012).[4] It is an approach that is based on the understanding that failures can be effective ways to innovate but only when they are intelligent and fast. Intelligent refers to risk-taking in a deliberate and calculated fashion, where the risks are minimised as much as possible. In addition, it stresses the intention to learn from (failed) experiments. The fast aspect of IFF refers to the frequency and length of experiments; ideas should be tested as soon as possible so hopeless candidates can be eliminated, and resources spared (Tahirsylaj, 2012).

Another approach to trial and error in innovation and managing uncertainty, named lean start-up, originates from the entrepreneurial world. While it originates as a management approach for start-ups, it has been increasingly applied to large organisations as well (Blank, 2013; Edison, Wang & Abrahamsson, 2015). Its main characteristics are iterative development and early, frequent customer feedback (Edison, Wang & Abrahamsson, 2015; Reis, 2011). The term "lean" indicates that the investment of resources is minimised as much as possible until a scalable business model has been developed (Blank, 2013; York & Danes, 2014). Lean start-up proposes a systematic innovation process based on continuous experimentation and hypothesis testing to deal with the extreme uncertainty inherent to innovative start-ups (Edison, Wang & Abrahamsson, 2015). Similar to IFF, lean start-up conceptualises failure (i.e. rejected hypothesis or experiments), as inevitable and crucial for the innovation process. Deliberate and planned experimentation is encouraged. Hence, both approaches assume that experimentation is feasible but stress the need to minimise the impacts of potential failures.

4.3.2 Identification of failure

According to the reviewed literature, failure plays a vital role in innovation processes. Interestingly, while the discussion of failures is prominent, there is no explicit discussion on how failures are identified. Perhaps this originates from the fact that both approaches

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[4] Variations of this term exist, like "Fast Failure," "Failing forward," and "Fast Forward Failure," but all refer to the intelligent use of failures to promote learning (Tahirsylaj, 2012).

encourage deliberate experimentation and hypothesis testing. Hence, a rejection of a hypothesis or a failed experiment is almost automatically identified, especially given the focus on fast and continuous feedback in both approaches.

This suggests that failures are understood as individual, small-scale events that can be identified and absorbed by individual units in the organisation. At the same time, the literature also discusses failure of an entire organisation, usually indicated by the organisation's inability to innovate successfully or to become profitable (Blank, 2013; Edison, Wang & Abrahamsson, 2015). However, this is often described as the result of failing to implement (a variation of) the two approaches and hence, does not refer to the identification of failures within these approaches. Table 3 summarises the implications of IFF and lean start-up for identifying and coping with failure.

Table 3. Approaches to identifying failure in R&D

Name	**Description**	**Main steps and tools used for identifying failure**	**Example literature**
Intelligent Fast Failure	Approach to risk and learning management focussing on repeated, fast and intelligent experiments to generate knowledge.	Designing well-informed trials to test ideas and assumption and minimising sunk costs to avoid unnecessary losses. Anticipating failure and collecting fast feedback to monitor potential negative outcomes.	*Theory*: Iske, 2019, Matson, 1991; Tahirsylaj, 2012 *Application*: McGrath, 2011; Tahirsylaj, 2012
Lean start-up	A systematic innovation process based on iterative experimentation and hypothesis testing, informed by continuous feedback.	Development of experiments and hypothesis to test assumptions. Continuous collection of customer feedback during the innovation process before large investments are made.	*Theory*: Blank, 2013; Reis, 2011; York & Danes, 2014 *Application*: Edison, Wang & Abrahamsson, 2015; Reis, 2011

4.3.3 Classification of failure

Two classifications of failure can be discerned from the reviewed literature. Firstly, there is a distinction between intelligent and pointless failures. The intelligent failures are failures that result in some sort of value, often information or lessons learned, without making preventable mistakes or taking unnecessary risks (Edison, Wang & Abrahamsson, 2015; Iske, 2019; Tahirsylaj, 2012). Pointless failures are those that do not result in any learning or new information and could have been avoided or mitigated. These pointless failures require better innovation management, for example, by the implementation of the two approaches discussed in this section. Intelligent failures should not be avoided but promoted.

A second distinction relates to the fact that the failures discussed in the literature are predominantly individual experiments. As mentioned previously, it is these individual incidents that are at the centre of the literature. Failures with an impact beyond the individual experiment or organisation, for example, the development of a product that is harmful to society, are not elaborated on in the reviewed literature. That is not to say that these failures do not occur. However, it is suggested that iterative and continuous experimentation and feedback could prevent these larger failures from occurring.

4.3.4 Conclusion

Because innovation processes are uncertain, failures are to be expected. Following the conceptualisation of failure that arises from the literature on R&D, failures are also useful because they generate knowledge. Hence, the general occurrence of failures can be anticipated and is perhaps even intended. However, the exact outcomes of experiments can often not be foreseen. This makes failures a great source of knowledge, but only if they are the result of thoughtful and cautious experimentation.

5. Discussion

The three bodies of literature discussed above illustrate that there are distinct understandings of failure to be found along the Process Knowledge Spectrum and that these result in diverse strategies for identifying failure. Hence, the understanding of failure on which attempts to identify failure are based influences the type of identification strategies that are used. In turn, this affects the type of failures that will be identified or missed.

This section aims to connect the three previously described understandings of failure to the discussion on failure in development. However, the three bodies of literature originate from organisational contexts that are (predominantly) anchored in traditions of private enterprises with a focus on profitability and competition. This results in accountability, planning, and evaluation structures that are fundamentally different from development practice. Hence, this section builds on Jabeen's (2018) four aspects of classification for unintended effects in international development to form a bridge between the three bodies of literature and the development context. From there, it develops preliminary action perspectives for the identification of failures in international development that follow from these three distinct understandings of failure.

5.1 Routine processes: measurement makes perfect

One of the key characteristics of the literature on production and manufacturing is its reliance on predetermined indicators and quantified risks, resulting in a conceptualisation of failure as something predictable and preventable. When comparing this conceptualisation of failure with the typology of unintended effects by Jabeen (2018), it appears that the methods for identifying failure are aimed specifically at identifying anticipated, negative unintended effects. The high *knowability* of the failures and the deep understanding of their causes and effects makes that the use of statistical monitoring processes and quantitative risk prioritisation can help to identify the most critical failure risks. Given this high process knowledge and the strict monitoring, failures can be identified before they escalate both in location and time. Hence, both the *distribution* and *temporality* of failures are limited.

Following this understanding of failure, three action perspectives for identifying failure in international development can be discerned. Firstly, there is the prioritisation of risks. Through quantitative risk assessment strategies, potential failures can be identified and ranked according to their criticality. This can be seen as the anticipation of failures. Failures with a high criticality are prioritised in monitoring and prevention efforts. Secondly, strict monitoring of the potential failure indicators is vital. If the right indicators are appropriately monitored, failures are prevented or resolved before they have any far-reaching consequences. Lastly, given the assumed predictability and understanding of potential failures in routine processes, once a failure has been identified, it can be resolved, and the process can continue without any fundamental modifications.

These action perspectives could be, and perhaps are, reflected in international development M&E practices. For example, identifying risk factors and proposing indicators to monitor them are essential aspects of any project proposal. The strategies to prioritise risks discussed in the reviewed literature could help steer resources to the prevention of and response to those failures that are most critical, increasing the efficiency and stability of interventions. Furthermore, focussing on statistical monitoring as a strategy for failure identification suggests a need for increased monitoring and data analysis efforts and resources.

5.2 Complex processes: practice and flexibility are key

The literature on failures in complex socio-technical processes is characterised by the tension between the need to avoid failures and the complexity of identifying and preventing these failures. The uncertain nature of complex processes makes it impossible to monitor all possible risk factors, something that is widely applicable to social development interventions (Burns & Worsley, 2015; Jabeen, 2016; Morell, 2010; Ramalingam, 2013; Westley, Zimmerman & Patton, 2009).

When looking at the *knowability* aspect of the typology by Jabeen (2018), the literature on socio-technical processes is primarily concerned with unanticipated unintended effects. The strategies discussed are aimed at sensing and dealing with failures that were not anticipated during the design of a process. This concerns both unforeseen but foreseeable failures and unforeseeable failures. That is, while foreseeable failures can theoretically be predicted, not all foreseeable failures are actually foreseen (Jabeen, 2018). When looking at the other three aspects of classification by Jabeen, the failures in complex processes can be characterised as those with a potential for extremely negative consequences (*value*) that quickly spread through an entire system (*distribution*) and are characterised by (delayed) feedback loops (*temporality*).The literature suggests that crisis simulation, backup systems, and open discussions about potential and past failures could help foresee and respond to these failures in time. The unforeseeable failures that are often caused by dysfunctional interactive complexity are much harder to identify upfront and require flexibility in the face of unprecedented situations.

Hence, the literature also suggests that anticipating and preparing for unexpected failures is critical. Due to the uncertainty about the nature of future failures in complex processes, the first action perspective that can be discerned from the literature is the promotion of a general awareness of the possibility of failures. In the international development context, active preparation through crisis simulation and scenario analysis could contribute to this awareness and help identify foreseeable failures. This should go together with an open culture around failures, which could be stimulated by interdisciplinarity in staff and the analysis of past near misses.

A second action perspective is related to flexibility and resilience in the face of failure. Since complex socio-technical processes are often faced with unforeseeable failures, the anticipation of all possible failures is impossible. Standardised procedures and clear formal structures can ensure stability and quality control in complex processes. However, unprecedented situations might require more flexibility from those involved. In the context of international development, this might materialise in flexibility regarding planning, budgeting, or project outcomes, among others. Management approaches that are aimed at increasing flexibility, like adaptive management, could potentially improve the resilience of international development interventions in complex settings.

5.3 Innovation processes: fail but do it fast

The literature on R&D reveals a general understanding that failure is to be expected. Hence, when looking at the *knowability* aspect of Jabeen's (2018) typology, one could argue that the failures that occur in innovation processes could be categorised as anticipated. At the same time, the specific nature and consequences of individual failures in innovation processes are often unpredictable, and hence fit Jabeen's category of unanticipated (both foreseeable and unforeseeable) effects. Furthermore, while failures at R&D are still of negative *value*, they also have the potential to create positive contributions. Related to Jabeen's dimension of the *temporality* and *distribution* of unintended effects, the focus on fast feedback indicates that especially instant failures that take place within the experimentation setting will be identified.

This focus on repeated and fast experimentation indicates the importance of seeking continuous feedback for identifying failures. Hence, a first action perspective that arises from the reviewed literature on R&D is actively seeking feedback, especially from those who are directly affected by an innovation, like the beneficiaries in development interventions. In addition, enabling short innovation or planning cycles is vital to ensuring that the acquired feedback can be incorporated as soon as possible and that resources are spared. In the context of international development, this could be reflected in, for example, increased flexibility in budget and planning in combination with shorter planning cycles to allow for shifting insights about what works. The use of progressive scaling strategies for interventions would also mirror the innovation strategies discussed in the literature. Furthermore, the open-ended nature of R&D does not allow for exact and predetermined evaluation criteria, requiring more open-ended M&E strategies.

A second, less explicit, action perspective that can be discerned is a general acceptance of the occurrence of failure and the perception of failures as valuable sources of information. Acceptance of a certain level of "failure rates" in development interventions by development actors could legitimise and promote active, intelligent experimentation. Simultaneously, this would make the termination of unsuccessful "experiments" or interventions less consequential.

5.4 Connecting the dots

The discussion above illustrates how Jabeen's (2018) aspects of categorisation of unintended effects can be integrated with the understandings of failure that are derived from the three bodies of literature. The integration of the dimension of *knowability* is perhaps the most straight forward, as the levels of knowability overlap with the levels of uncertainty that shape the Process Knowledge Spectrum. That is, the literature on routine processes is predominantly concerned with the identification of anticipated unintended effects, whereas the literature on complex and innovation processes focusses on strategies for identifying unanticipated effects. For the latter two, the other three aspects of Jabeen's typology (*value, distribution,* and *temporality*) provide the clearest distinction. Table 4 combines Jabeen's aspects of classification with the three ideal types of the Process Knowledge Spectrum.

The integration of these bodies of knowledge has added value because it provides a detailed and explicit framework to unravel what failure is and how it might manifest itself in the development context. The idea of the Process Knowledge Spectrum and the three bodies of literature that are related to its ideal types illustrate the diversity of failure and strategies to identify it. Furthermore, it is a tool to anticipate what kind of failures might be most prevalent in any given process. The four aspects of classification by Jabeen (2018) help to make the differences in the understanding of failure explicit. In addition, they serves as a necessary bridge between development studies and the explicit discussion of failure in contexts that are unrelated to international development. What results from this integration is a framework for international development organisations and researchers to assess different types of failures and distinguish appropriate (combinations of) failure identification strategies. Furthermore, it may help identify blind spots in current approaches. Above all, it provides a framework to enable the explicit conversation about failure in development studies and illustrates the diversity of the events that we call failures.

Table 4. A framework for understanding failure in international development, based on the typology of unintended effects and the three ideal types of the Process Knowledge Spectrum

	Knowability	**Value**	**Distribution**	**Temporality**
Routine	Anticipated	Negative	Localised failure	Monitoring instruments are aimed to identify failures before they occur or escalate
Complex	Unanticipated (foreseeable and unforeseeable)	(Extremely) negative	Tends to escalate and spread throughout the system	Undetermined, but delayed feedback can cause large lags between failures and their manifestation
Innovation	Unanticipated (foreseeable and unforeseeable)	Negative but potentially in combination with positive effects	Remains within the experiment setting	Generally instant identification within the experiment setting

6. Conclusion

This paper has aimed to connect existing scholarly perspectives on failure and its identification to the ongoing discussion on unintended effects in development studies. Both conversations contribute insights that, when combined, enable a more concise and meaningful discussion on failures in development. The discussion of the three bodies of literature that represent the three ideal types on the Process Knowledge Spectrum illustrates that how failure is understood influences what types of failure will be identified, and what types will be overlooked. The typology of unintended effects by Jabeen (2018) has provided a tool to translate these different understandings of failure to a vocabulary that is affiliated with development studies. Furthermore, Jabeen's four aspects of classification help to unravel the various understandings of failure and make their differences more explicit.

While this paper discusses three ideal types of processes of the Process Knowledge Spectrum, the fact that these are based on a spectrum highlights that organisations might need to deal with a variety of failures at the same time. That is, organisations can engage in multiple processes that are associated with different locations of the spectrum. As a result, conversations about failure in development, both in practice and research, need to acknowledge failure's diverse manifestations, while simultaneously avoiding discussing types of failures as exclusive categories. It also means that development organisations need to develop (a range of) identification strategies that can deal with failures in all its forms.

The framework that results from the integration of the implicit and explicit conversations on failure can help international development actors analyse failures and their strategies to identify it. It can serve as a tool for assessing whether their current approaches are appropriate for the type of processes that they are engaging in and inform decisions on how to improve them. In addition, the framework provides a starting point for future research on how international development organisations deal with failure and the practicalities of different identification strategies. That is, the framework presented in this paper adds precision and clarity to the discussion of failures in international development by unravelling the concept of failure.

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