Transforming Uncertainties into Risks and Poverty Alleviation: Lessons Learnt from the Successful Rescuing of Miners in Chile

Driouchi, Ahmed and Malki, Karim

IEAPS, Al Akhawayn University, Ifrane, Morocco

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Transforming Uncertainties into Risks and Poverty Alleviation: Lessons Learnt from the Successful Rescuing of Miners in Chile

By:

Ahmed Driouchi[1]

&

Karim Malki[2]

Institute of Economic Analysis & Prospective Studies (IEAPS),
Al Akhawayn University, Ifrane (AUI),
Morocco

Abstract:

The objective of this paper is to suggest how the Chilean model used to rescue the 33 miners trapped underground, can be used to accelerate the development of new means for poverty alleviation mainly in developing economies. For that, the Chilean model is described and analyzed within the framework of uncertainty and risk with emphasis on the success of all operations, under time constraints. The attained results underline that this "point in time" process can be used to extract poor individuals and households and sustain their inclusion in normal economic and social activities. But, this is conditioned on the development of further participative research-actions, innovations and monitoring processes applied to multiple small scales, well localized and targeted poverty alleviation projects.

[1] Corresponding author: Ahmed Driouchi, email: A.Driouchi@aui.ma. Ahmed Driouchi is Professor of Applied Economics and Dean of the IEAPS of Al Akhawayn University Ifrane, Morocco http://www.ieaps.ma
PO Box 104, Avenue Hassan II, 53000, Ifrane, Morocco
2 Corresponding author: Karim Malki, email: K.Mlaki@aui.ma . Karim Malki is Research Assistant at IEAPS

Introduction:

Disasters, such as those that affect miners all over the world[3] lead often to important catastrophes that trigger lives and could result in compromising and reducing the fulfillment of human rights.

This paper is about uncertainties and risks of death related to trapped workers in the mining context of Chile[4]. It aims at showing how the recognition of human rights of these miners and their families is an important incentive that has mobilized different partners to develop and rescue the miners. The focus is also placed on the lessons gained in mobilizing technologies, institutions, cooperation and different pieces of knowledge but mostly humans and expertise to ensure the extraction of the trapped individuals. This is used to feed the need for continuously extracting individuals and groups from below the poverty line to ensure their inclusion in economic and social activities and sustain their wellbeing. Extraction from poverty is a means to express a human right to life. This is assumed to be directly related to the knowledge gained from the pressure of the hazards and risks faced with the successful extraction of the 33 Chilean miners.

Most natural hazards and disasters especially those that affect the lives of human beings, require information and signals that transform ignorance and uncertainties[5] into sequential risks[6]. This transformation[7] opens new options that can be conceived to set practical rescue plans. This stage of transformation of uncertainty into risks is intensive in search as it is conducted under time constraints given the limited level of resistance of humans to the consequences of the disasters[8]. The involvement of humans in such hazards and with their eventual consequences on lives, add further complexities and pressure. The natural mobilization of family members[9] and local communities[10] are other sources of complexities[11]. Any signal perceived, by those that search and by the families

[3] A brief summary of mining disasters on New York Times shows the frequency of hazards and the dangers related to mining. Please consult : http://topics.nytimes.com/top/reference/timestopics/subjects/m/mines_and_mining/mining_disasters/index.html

[4] In San Jose copper-gold mine near Copiapo in northern Chile. This started on August 5th,2010 and ended October 13th,2010. BBC has a large and detailed web coverage of this event (http://www.bbc.co.uk/news/special_reports/chile_mine/)

[5] "A situation where there is no basis whatever upon which to form any calculable probability". P. Davidson, 1988. *A technical definition of uncertainty and long-run non-neutrality of money.* Cambridge Journal of Economics 1988,12, p.329

[6] Reference to different sequences of risks where successive reductions are expected (see Bayes at : http://en.wikipedia.org/wiki/Bayes_estimator)

[7] Transforming uncertainties into risks is an important step that leads to calculation and management of risks as quantitative information is made available by this transformation

[8] Survival possibilities are conditioned by the levels of resistance of humans to conditions under which they are placed (temperature, oxygen, food, water)

[9] Established in a "tent city" called "Camp Hope" located near the mining site.

[10] As indicated by the media, this has expended nationally to include the Government and the personal involvement of the President. The media has been continuously providing information that has mobilized the international community.

[11] This concerns the logistics, the communication system and the support system to physical and psychological health of families and other participants

leads to adjustments in the attitudes and actions[12]. Positive signals of survivals imply acceleration of the search and further willingness to pursue the rescuing processes. This also strengthens the ties between all players[13] as shifts in expectations lead to anticipating, individually and as group, the best outcome that is "a successful rescue".

This is a familiar exercise for firefighters[14] and for professional rescuers and humanitarian groups[15] but the rescue model of the 33 miners trapped underground in the gold-copper mine of Chile provides further insights into conceiving, implementing and ensuring successful operations under sequential risk reduction and elimination.

The main traits and episodes before and within the rescue process are discussed here in relation to the right to life. These human rights account also for the hopes and expectations of people in Chile and outside.

The example of these 33 miners appears to be unique after the reception of signals of life with decent probabilities of rescue. It shows also that humanitarian incentives can assemble all the needed means in a very limited time to create what can be termed as a miracle. With almost 70 days under 700 meters underground with high temperature and humidity and under absence of light, the miners sent messages, survived and got rescued.

The parallel concern is related to poverty alleviation as a human right to health and decent living conditions. How the above model can be used to tackle successfully poverty, vulnerability, uncertainty and risks in ways similar to the one used for the 33 miners of Chile?. How those living under continuous stress can be progressively extracted and included in normal living conditions? How these efforts can be permanently implemented under continuous monitoring? What appropriate technological and institutional innovations can be mobilized and adapted to different locations, societies and economies to ensure extraction of the poorest individuals and population segments?

This paper is composed of three paragraphs. The first one is devoted to a literature review about risks and uncertainty as well as on disaster risk management. The second focuses on a descriptive analysis of uncertainties and risks related to the model of "The 33 Chilean miners". The last paragraph focuses on the main directions learnt from this model and that can apply to poverty alleviation viewed as "extraction" of the poorest individuals and households from under the poverty line to ensure their sustainable inclusion in normal activities.

[12] As positive signals were exhibited, positive expectations were observed at all levels including the miners
[13] Players include: rescuers, families and communities and the trapped miners. All seeking success to the rescuing operations
[14] In all economies there are professionals that devote their energy and talent to fight different forms of disasters
[15] The mobilization was general and this included Nongovernmental Organizations and volunteers from Chile . Their role was in supporting the families, authorities and rescuers

I. Literature Review

The difference between uncertainty and risk was pioneered by Knight(1921)[16]. This distinction is based on the availability of information about probabilities of outcomes. For this author, uncertainty is characterized by the absence of information about the random events. A risky situation is directly related to the existence of partial information and mainly the knowledge of the probabilities.

Other authors have expanded the concepts and the models involving risks and uncertainty. The contributions of V.Neumann and Morgenstern (1994)[17], Savage (1972)[18] among others have been essential in the expansion of theories and decision making models and their applications mainly in the area of economics.. This has been expanded with the development of different expected utility models, attitudes towards risks and mainly with the expansion of behavioral economics.

Sociologists such as Zinn (2006)[19] have also added further qualitative pieces to the distinction between uncertainty and risks. This latter defines risks as the intermediate stage between uncertainty and determinism. For this author, risk is perceived as a response to threats facing individuals and groups. For Zinn (2006), risk is perceived as a rational strategy to transform unmanageable contingencies to manageable ones. Another perspective is introduced by O'Malley (2004)[20] as the governmentalist approach. It states that the focus should not only be on the transformation of uncertainty to risk but also on the management of uncertainties using strategies (including the moral and political aspects).

There is a large body of literature related to disaster risk management and vulnerability reduction with linkages to protecting the poor. Different authors from series of disciplines have been looking at the issue in connection with the field work done by NGOs, Governments and international humanitarian institutions (Yodmani, 2005)[21]. This literature has observed the links between natural disasters and unresolved development issues as leading to further poverty. It recognizes the necessary shifts in paradigm from an approach of relief to disaster management as hazards are not one-time events. Schilderinck (2009)[22] has focused on two major theories that govern disaster risk reduction. The first one is around disaster pressure and release model that focus on the

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[16] Frank H. Knight. *Risk, Uncertainty, and Profit*. Hart, Schaffner & Marx; Houghton Mifflin Company, Boston, MA, 1921.

[17] John von Neumann and Oskar Morgenstern. *Theory of Games and Economic Behavior*. Princeton University Press (1953 edition), Princeton, NJ, 1944.

[18] Leonard J. Savage. *The Foundations of Statistics*. Dover (1972 edition), New York, 1954.

[19] Jens O. Zinn. *Recent Development in sociology of Risk and Uncertainty.* Historical Social Research, vol 31 2006 – No 2, pp275-286

20 O'Malley, Pat (2004). Risk, uncertainty and government. London: Glashouse Press.

21 Suvit Yodmani (2005) Disaster Risk Management and Vulnerability Reduction: Protecting the Poor. Paper Presented at The Asia and Pacific Forum on Poverty Organized by the Asian Development Bank

[22] Gerard Schilderinck (2009). *Drought cycle management in arid and semi-arid Kenya: A relevant disaster risk reduction model?* Retrieved from: http://www.ngovoice.org/documents/100-10035b%20-%20FINAL%20DRR%20research%20report.pdf

characteristics of individuals and groups in relation to their capacity to cope, resist and recover from the impact of a natural disaster. Besides that, it includes the profound causes behind vulnerability and the processes that generate effects to support and face the calamities. The likely levels of safety and readiness constitute the last dimension. The second model is termed as that of access. As in Wisner et al. (2003)[23], this model is introduced as related to the capacity of the unsafe household conditions that lead to a given level of capacity of accessing resources and to respond to the impacts of hazards. This capacity of access can be expressed under income, education and health, among others.

This review shows that there are different views about uncertainty and risks. But they all converge in relating uncertainty to full ignorance and absence of information and risk to the existence of partial information. They all recognize that the transformation of uncertainty to risk is a major step in the management of disasters, risks and hazards.

II. The Rescue Model: From uncertainty to Risks in the rescue model of the "33 miners"[24]

This is the empirical central part of the study that helps in setting means for accelerating the tackling of poverty alleviation and enhancing the levels of human rights as they relate to the lives of human beings. It is based on the description of the events that took place during the disaster of trapped miners in Chile. This description is composed of four stages that are respectively reviewed here.

Stage 1: Search for likelihood of survival

This stage is characterized by high uncertainty. After the collapse of the mine, initial local search team started looking for any signal that can provide information about the eventual consequences of the accident. The likely consequences on the miners are the main expected targets of this preliminary search. Risks of further collapses are contributing to the acceleration of this search as they can worsen the consequences. The technology of drills is used to attempt getting information. This has also generated more pressure on both rescuers and families as time elapses. The time constraint is related also to prior knowledge and experiences about human survival capacity under unknown underground conditions. It is expected that both rescuers and families are becoming pessimistic by the end of this first stage. In Day 17, a signal of survival is issued by the miners stating that they are all in life and "fine in the shelter"[25]. Details about uncertainties, risks and actions are summarized in Table 1 below.

[23] Wisner. B, Blaikie, P., Cannon, T. and Davis, I..: *At risk, second edition: natural hazards, people's vulnerability and disasters*, 2003

[24] All the information are from the special on the Chile Mine at: http://www.bbc.co.uk/news/special_reports/chile_mine/

[25] Translation of the original message in the Chilean news El Mercurio at http://www.mer.cl/index.asp?fecha=2010-08-23

Table 1: Stage 1 from the start of the disaster to finding signal of survival Day 0 to Day 17 (Aug 5th – Aug 22nd)

Uncertainty and Risks	**Actions**	**Observations**
Uncertainty with full ignorance	Local search for information	Due to collapses, the operation was aborted
High risk of further collapses	Drilling throughout the mine in hope to find survivors	Miners left a message with their location and number
Uncertainty with full ignorance. Families under full uncertainty	Continue the search process	As a first attempt to improve safety
Signal about survivors captured		

Stage 2: After the discovery of survived miners

This stage raised uncertainties about miners' physical and mental health. The local rescue team gave place to a professional team of doctors and engineers as well as international institutions (mainly NASA). From previous experiences and a video footage of the trapped miners, we know that deterioration of health and psychological conditions are unavoidable. The latter broke the previous uncertainty into different risks that can be dealt with separately (as listed in Table 2 below).Rescue team used NASA technological advancements in food to administer enhanced rehydration tablets and high energy food to the survivors. Psychological help was insured by the limited communication that rescuers and family members had with the miners. Families of miners also received psychological counseling. At the end of this stage, all the players (miners, families and rescue team) had high expectations vis-à-vis the survival.

Table 2: Stage 2 from finding of miners to starting of the rescue plans Day 17 to Day 26 (Aug 22nd- Aug 31st)

Uncertainty and Risks	Actions	Observations
Uncertainties about physical and mental health	Chilean authorities seek help from the NASA	To insure the mental and physical health of trapped miners during a period that will last for several months
	Assignment of specialists in rescuing, medical doctors, engineers and psychologists for miners and families assistance	
Risks of likely deterioration of health conditions (based on previous experiences)	Administrating special food, water and medicines: rehydration tablets and high-energy glucose gel	This was done through a pit allowing the exchange of capsules
Risks about psychological repercussions (based on previous experiences)	Limited communications with miners	
	Psychological assistance for miners and their families.	
Signal about miners conditions (video footage)		

Stage 3 : Rescue plans launching

Stage 3 was crucial in the rescue process. There was uncertainty about the plan to follow, the technology to use and the timing required to reach the trapped miners. The international cooperation and professional rescuers used information from previous disaster and Aerospatiale technologies to transform uncertainty into different risks that can be managed. The rescuing engineers designed three different plans (referred to as Plan A, B and C) each of those is based on a drilling technique and the goal was to find the optimal plan in terms of time to reach the trapped miners. Plan A used a drill from mine digging to reach the miners' refuge. This operation was expected to last from 3 to 4 months and was the first plan to be launched on Day 26 (Sep 31st). Plan B used a drill from oil and gas drilling industry and a team from Chile and United States. The main idea is to widen a pilot hole drilled on Day 32(Sep 5th) (the widening started 15 days later). Plan C started on Day 45 (Sep 19th) with the idea of using a bigger drill and begging digging at a wider diameter. Plan be was the first to hit the target in Day 65 (Oct 9th) and the other plans were halted. Meanwhile, there was now a possibility to establish a sustainable communication with the miners that allowed reducing psychological distress (watching the national team game and receiving Pope blessing) as well as the risks related to health (sending air tanks and equipment to monitor heart rates). At the end of this stage, the signal of reaching the survivors brought up the expectation of success of rescuers, families and the 33 miners. Details of this stage are described in Table 3 below.

Table 3: Stage 3 from launching of the first plan to reaching the miners Day 26 to Day 67 (Aug 31st- Oct 11th)

Uncertainty and Risks	Actions	Observations
Uncertainty about rescue plans and duration	Designing different plans with cooperation of engineers, oil drilling firms and international help of NASA	Plan A was using water drilling techniques and expected to last 3 to 4 months. Plan B consisted on drilling a hole then widening it: it insures rescue in less time. Plan C used oil drilling platform. Plan B was successful and all others halted
Signal about the possibility of establishing sustainable communication		
Risks of mental and psychological diseases from the long period that the rescue will take (based on previous experiences)	Make the stay in the mine enjoyable (diffusion of football game)	The previous record was of 50 days and this imposes more care in this operation
	Pope sending personal blessing for miners	
Risks of physical health deterioration (based on previous experiences)	Sending air tanks and equipment to monitor miners' heart rates	Miners were exposed to high humidity, low oxygen and low luminosity
Signal about reaching trapped miners		

Stage 4: The Rescue Process

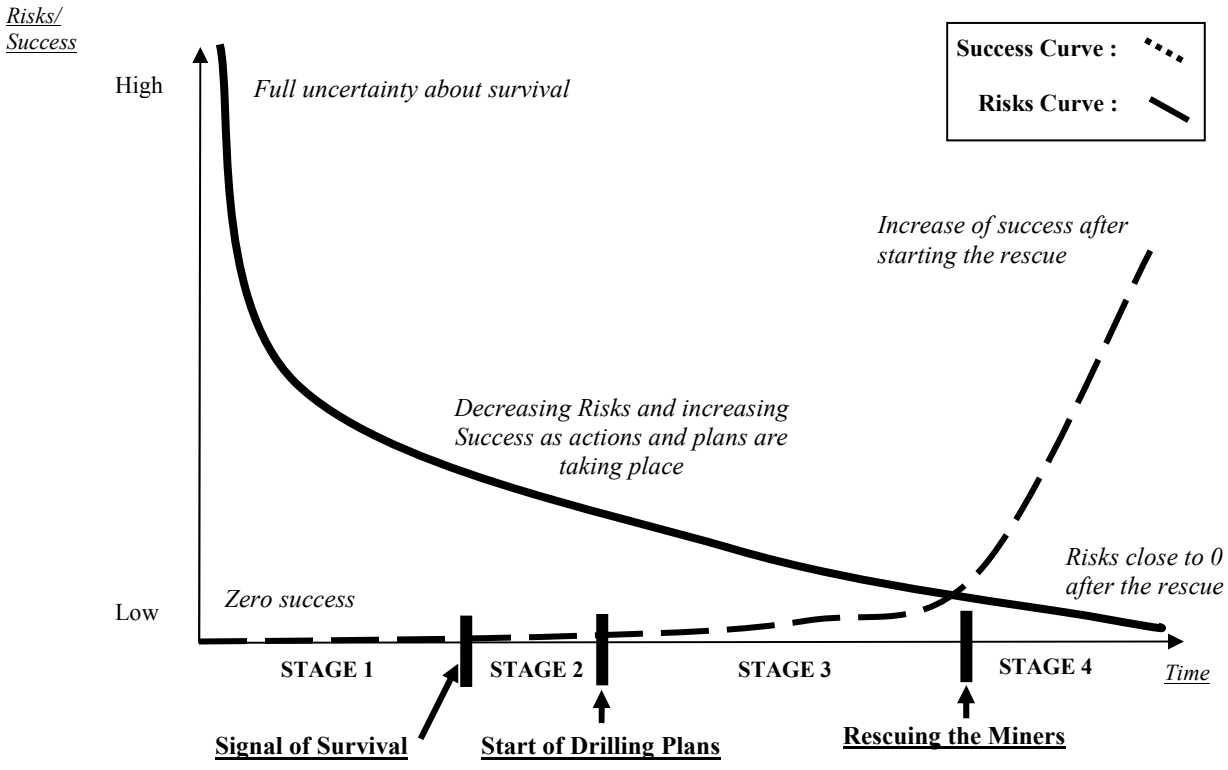
Reaching the rescuers raised another uncertainty about how to bring the trapped miners to the surface in the best way possible. The rescue team engineered a capsule and a put logistics that will take care immediately of the rescued one by one. The test of this plan was done first on a fit miner to cope with any complication. The operation was a success sending a signal to start the rescue and increasing the three players' expectations. Priority was given to elders and miners in bad health conditions with the capsule taking down a medical rescuer each time to administer first aid to the survivors. The process took two days to bring all the miners to the surface. However, this does not mark the end of the disaster since post-traumatic complications should be taken into account. This experience of 33 miners trapped for 69 days is the first of its kind and this raised uncertainties as to the "after disaster" part. The rescue team planned to follow up the physical health of each miner as well as the psychological one. The international community also helped in this process by sending gift to the rescued, inviting them to events and talk show and most importantly considering their bravery. Table 4 summarizes the processes that lead the successful rescue of all the miners.

Table 4: Stage 4 from the start of the extraction Day 67 to Day 69 (Oct 11th – Oct 13th) to present (the period after the disaster Day 69 (Oct 13th) to Present)

Uncertainty and Risks	Actions
Risks of complications and disease due to change in conditions	Special glasses were given to miners to protect them from the shocking change in luminosity
	When going down, the capsule was transporting a rescuer to start the first aid procedures
Uncertainty about the rescuing plan	Use a single capsule and start with a fit miner as a test
Signal about success in the rescue plan	
	Move to elders and urgent cases
	As a miner is brought up, a whole process was put in place to transport him by ambulance to a hospital, limiting the meeting with families and forbidding the near presence on media
	Each of the miners received 2 days of extensive medical care and follow ups.
Signal about successful rescue of the 33 miners	
Risks of post-traumatic complications (physical and mental, based on previous experiences)	Psychological assistance, compensations and gifts, invitations by many organisms and recognition for their bravery

The following figure shows the evolution of risks and success throughout the stages. Risks started unlimited (uncertainty) in the beginning of the disaster in Stage 1. As the discovery of survival happened in Stage 2, risks decreased remarkably. Several actions were undertaker, from sending food, water and equipment for miners to survive, to hedge against risks of physical and mental distress. In Stage 4, when the 33 miners were brought to the surface, the risks were decreased to the maximum. Only left was post-traumatic complications and risks. Success followed an opposite trend starting at zero (uncertainty) in the beginning of Stage 1. The discovery of the trapped miners increased the chances success in Stage2. As rescue plans started taking place in Stage 3, the expectations of the three players (namely rescuers, families and the 33 miners) increased. The definite increase in success happened in Stage 4 as the 33 miners are all extracted in a more or less good shape.

Figure: The evolution of Risks and Success during different Stages (source: from summary tables above)



III. Empirical Insights to Poverty Alleviation: What can be learnt from the above model?

The model introduces the steps that led to a full success. It shows how different partners under the authorities of Chile with the involvement of public, private and NGOs have mobilized technological, institutional and social means while accounting for several constraints, to extract the miners. This coordinated process has also involved the miners, their families and communities. The model shows also that possibilities of relief from the

consequences of disasters can be made possible. It shows also how efficient solidarity can be set to ensure successful realizations over limited time period.

Some will consider this model as concentrated over a limited time period and as "point in time" event and cannot be used to set plans for extraction of human beings from poverty and from difficult situations. Disaster management may not be easily applicable to poverty even though some experiences and publications have shown that there can be major links between management of hazards and poverty alleviation (see literature review). But the model considered here is related to highly successful process of relief, extraction and inclusion in normal activities.

The views that may not accept the extrapolation may change, when viewing the outcomes under the angle of successful extraction in a precise location. The continuous efforts and knowledge invested in appropriate technologies, institutions and organization over a given limited space and reduced number of poor households can ensure their sustainable inclusion in normal and promising economic and social activities. Technologies, institutional and organizational mechanisms can be used with the contribution of the target population to ensure revenue generating activities and investments that can be supported by different partners in a coordinated way. Agents of change besides the target individuals and households include also public, private and non-governmental agencies and associations. They also include bilateral and international cooperation.

These elements are consistent with the on-going actions pursued by different developing economies in poverty alleviation and attainment of the Millennium Development Goals (UNDP (2005); Akpomi (2009); The World Bank Group (2010)). But, the difference resides in identifying units of interventions that account for the appropriate scale of operations, the mobilization of adapted and appropriate technological and institutional means and the involvement of relevant partners. The directions that would support these actions need the mobilization of the knowledge that is necessary for the identification of target units, the mobilization of knowledge for the utilization and the creation of technological, institutional and social means. But, the targeting and the mobilization of different pieces of knowledge are required to be adapted, share and experimented with the concerned population. Those strategies and actions exist most of the time, in the poverty alleviation projects and even the targeting is occurring but acceleration is most of the time needed.

1. **Research action on poverty:**

Before treating poverty, there is a need to know about the attitudes, preferences and perceptions (mainly towards time, risk and different likely solutions) of the targeted individuals, households and populations. The mobilization of the methods of behavioral economics is crucial at this stage as it provides information about the likely drivers that affect the likelihood of decision making under uncertainty and risks. This knowledge can accelerate the processes through which different agencies and organization set strategies and appropriate actions for project design, organization and participation of the targeted

population. As stated by Camerer and Loewenstein (2004)[26], behavioral economics is adding more explanatory power to economics through its behavioral and physiological foundations. Similarly Madden (2000)[27], behavioral economics as the combination of all the economic principles and concepts with those of experimental methods and behavioral analysis add more practical meanings to the understanding of the attitudes of individuals and groups.

Using behavioral economics consists in conducting field experiments on poor individuals and groups to get insights about their likely decision making processes in risky situations with emphasis on time. Many studies have analyzed the behavior of the poor and series of results have been attained. Bertrand et al. (2004)[28] claimed that views diverge as to the degree of rationality of the poor's decisions. Some claim that poor's behavior is rational; they hold personal and coherent believes and are pursuing them consistently. For others, poor's behavior is limited by psychological and attitudinal biases thus making them followers and in need of guidance. The view proposed by Bertrand et al (2004), considers the poor's behavior pattern as moderate. A poor, as other people, holds weaknesses and biases. The only difference is that a poor has a much tapered error margin and this fact can make behaviors more pronounced leading to negative outcomes. From those findings, one can perceive the importance of experimental and behavioral economics as an attempt to elucidate the poor's attitude toward time, risk and possible outcomes. Among the practical attainments in this field, the contribution Tanaka et al. (2010) is promising for the successful elicitation of risk and time preferences in Vietnamese villages, through linking experimental and household survey data. The results show that villages with higher mean income, are less loss-averse and more patient. Also, household income is correlated with patience but not with risk.

2. Technology and institutional innovations:

As Chile engineered different devises and promoted institutional and organizational mechanisms, similar means as supported by research can be quickly identified and mobilized for each identified poverty unit. These instruments can be at the origin of new revenue generating activities but also new means to smoothing access to health and education among well identified and small poverty units.

As there are continuous needs to enhance the possibilities of revenue generating activities, further means are necessary because without further investigations, the current basket of production possibilities can become obsolete as this is observed in a lot of places around the world. This implies that there is definitely a need for innovation in both

26 Camerer, C. and Loewenstein, G. (2004). Advances in Behavioral Economics. Princeton University Press, Princeton, NJ

[27] Madden, G. (2000).Behavioral Economics: Concepts and Methods. In W. Bickel and R. Vuchinich *Reframing Health Behavior Change with Behavioral Economics* pp 3-27. Mahwah, NJ: Lawrence Erlbaum

[28] Bertrand, M., Mullainathan, S. and Shafir, E. (2004). A Behavioral-Economics View of Poverty. *Memos of the Council of Behavioral-Economics Advisors.* Vol 94 (2) pp 419-423. Retrieved on October 25th, 2010

in the business ideas as well as the way of mobilizing knowledge to implement them in the context of poor individuals and groups.

Institutional innovation can also include the use of local geographical indication that will set incentives for communities to expand niche products and services. Over the past two decades, products have experienced a significant move towards market differentiation in many parts of the world. As stated by Sauvée and Valceschini (2003): "In the current competitive universe, the definition of quality and the information on qualities are from now on at the heart of the competitive strategies of economic actors". The shift from imperfect information to a situation based on local signs has been recognized as welfare enhancing by different economists ((Stiglitz (1989), Tirole (1988)).

3. Identification, monitoring and evaluation

Two major approaches are introduced to ensure identification, targeting and monitoring of poverty alleviation. They include those developed as deprivation and social cohesion approaches[29].

3.1: The Deprivation Approach

The deprivation approach is based on the assessment of needs relative to the basic requirements that are not covered. Mack and Lansley (1985) added the identification of the on-going living conditions rather than income and expenditures. This approach follows the basic idea of Townsend (1979) who focused on the fact that poverty is also related to needs that are not socially satisfied but well perceived (Deutsch et Silber, 2008). This approach was initiated in Britain in 1980s in relation to health inequalities. But, as needs are interrelated, other components have been included. They include employment, consumption, housing, education and others. A second type of deprivation index was developed by Carstairs et Morris (1989). This is also based on 4 variables where 3 are the same as in Townsend's index. The fourth variable refers to the belongings to low social group instead of house ownership.
The third index that was developed earlier by Jarman (1983) was called the Score of Under-privileged Areas. This index was re-introduced in 1984 to assess the local demand for health services. Bossert et al. (2004) compared social exclusion to deprivation and found them convergent. The use of the deprivation index is practiced in the UK (ODPM, 2004), Japan (Hiraoka, 2001); Aya, 2006)., Ireland (CGLPP, 2005)., New Zealand (Salmond and Crampton, 2001; Salmond and Crampton, 2002 ; Salmond et al. 2005)., among other countries (Klasen,1997; Pampalon and Raymond, 2000; Saunders et al. 2007).

3.2: Social cohesion

The concept and practice of social cohesion have originated in developed economies and mainly in countries of the European Union (EU) where urban population is the most dominant demographic and economic segment. Social cohesion became important in the

[29] Further details are provided in FEMISE report 33-05 (see references).

UK with the urban social problems of the end of 1990s. This concept and practice have expanded to the rest of Europe with large debates that resulted in a generalization by the end of the year 2000 (Roberts, 1997). This resulted in different reports and publications on social cohesion and social inclusion that discussed the material and immaterial conditions that are fundamental to the determination of social cohesion in EU and in each individual member country.

Social cohesion is consequently a concept that describes social connectedness of individuals and groups with willingness to decrease economic inequalities (Hulse, 2005).

Social cohesion is confirmed to be a European concept that addresses poverty and exclusion as specified in 1992 Maastricht treaty and in reports of the Economic Council for Latin America and Caribbean (ECLAC) (2007). In this context, Latin American and Caribbean economies recognized the relevance of the concepts and practices of social cohesion.
In 2001, a system of measurement is introduced as the Laeken indices. These include indicators based on Income, employment, education and health factors. While the first set includes income, employment, education, health, housing, pensions and digital-divides, the second set accounts for cultural diversity, trust, participation, expectations and solidarity (Walter et al., 2004).

Conclusion:

The "Chilean model of the 33 miners" has been reviewed as related to the transformation of uncertainties into sequential risks with subsequent resolutions until the miracle is attained. In this process, the roles of technologies, institutions and other means have been emphasized as the main sources mobilized by different players in order to ensure the known success achieved. Coordination has been also found to be a major success factors with the involvement of local, national and international operators. This mobilization has also accounted for the major constraints where time has played an important role.

This description has suggested the setting of parallelism between the extraction of the miners and that of poor individuals and groups. The only major difference resides in the perception of time as discrete and limited for the exit from the described disaster and the continuity under which poverty occurs. This has suggested a model where identification, proximity and scale are major dimensions of interventions and where the development of research action, innovations and monitoring are necessary. These are likely to enhance the creation of new revenue generating activities with new instruments to access health and education in poor neighborhoods. Sustainability can be ensured through the use of localized indicators such as those of deprivation and social cohesion indices.

References

Akpomi, M. (2009). Achieving Millennium Development Goals (MDGs) ThroughTeaching Enterpreneurship Education in Nigeria Higher Education Institutions (HEIs), *European Journal of Social Sciences – Volume 8, Number 1.*

Aya, A (2006). "Empirical Analysis of Relative deprivation and Poverty in Japan," National Institute of Population and Social Security Research; *IPSS Discussion Paper Series,* No.2005-07.

BBC (2010). Chile miners: Supplying the miners. British Broadcasting Corporation. Retrieved on October 25th,2010 from http://www.bbc.co.uk/news/special_reports/chile_mine/

Bertrand, M., Mullainathan, S. and Shafir, E. (2004). A Behavioral-Economics View of Poverty. *Memos of the Council of Behavioral-Economics Advisors.* Vol 94 (2) pp 419-423. Retrieved on October 25th, 2010

Camerer, C. and Loewenstein, G. (2004). *Advances in Behavioral Economics*. Princeton University Press, Princeton, NJ

Carstairs, V. and Morris, R. (1989). "Deprivation: explaining differences in mortality between Scotland and England and Wales." BMJ; 299: 886-9.

CGLPP- County Galway Local Poverty Profile 2005. "Deprivation and its Spatial Articulation in the Republic of Ireland"

Davidson, P (1988). A technical definition of uncertainty and long-run non-neutrality of money. *Cambridge Journal of Economics* 1988,12, p.329

Deutsch et Silber (2008). "On the Watts Multidimensional Poverty Index and its Decomposition" *World Development*, Vol.36, 2008

European Foundation for the Improvement of Living and Working Conditions. (2008) *Social cohesion*. Retrieved on October 25th, 2010 from: http://www.eurofound.europa.eu/areas/socialcohesion/index.htm Data of Access 10/01/2008)

Hiraoka, K. (2001). *Elderly Age and Social Inequality.* Tokyo, Univerity Press, 2001.

Hulse, K. (2005) Housing, housing assistance and social cohesion in Australia *Monash Research Centre Final Report. Retrieved on October 25th2010 from*: http://www.ahuri.edu.au/publications/p50300/)

Jarman, B. (1983). "Identification of underprivileged areas." *British Medical Journal*; 286: 1705-9.

Jarman, B. (1984). "Underprivileged areas: validation and distribution of scores." *British Medical Journal*; 1587-1592.

Klasen, S (1997). "Poverty, Inequality and Deprivation in South Africa: An Analysis of the 1993 SALDRU Survey," *Social Indicators Research*, 41: 51-94.

Knight, F (1921). Risk, Uncertainty, and Profit. Hart, Schaffner & Marx; Houghton Mifflin Company, Boston, MA, 1921.

Madden, G. (2000).Behavioral Economics: Concepts and Methods. In W. Bickel and R. Vuchinich *Reframing Health Behavior Change with Behavioral Economics* pp 3-27. Mahwah, NJ: Lawrence Erlbaum

Mack, J. and Lansley, S. (1985). *Poor Britain.* London: George Allen and Unwin.

Neumann, J and Morgenstern, O (1944). *Theory of Games and Economic Behavior*. Princeton University Press (1953 edition), Princeton, NJ, 1944.

Nolan, B. and Whelan, C. (1996) *Resources, Deprivation, and Poverty*. New York: Clarendon Press, 1996.

ODPM- Office of Deputy Prime Minister (2004). *The English Indices of Deprivation 2004: Summary (revised),* Neighbourhood Renewal Unit.

O'Malley, P (2004). *Risk, uncertainty and government*. London: Glashouse Press.

Pampalon, R. and Raymond, G. (2000). "Deprivation Index for Health and Welfare Planning in Quebec," Volume 21, N° 3, Retrieved on October 25th, 2010 from:: www.bmj.com/cgi/content/full/310/6986/1067/c

Roberts, E. (1997): The Concept of Economic and Social Cohesion in the Treaty Establishing the European Community in *The Single European Act – a turning-point in the European integrationprocess, The watercarriers of the Netherlands European policy* ed. H.H.J. Labohm, 1997

Salmond, C. and Crampton, P. (2001). "NZDep96 - What does it measure?" *Social Policy Journal of New Zealand*, 17, 82-100.

Salmond, C. and Crampton P. (2002). "NZDep2001 Index of Deprivation."

Salmond, C., Crampton P. and Sutton, F (1998). "NZDep91: A New Zealand index of deprivation," *Australian and New Zealand Journal of Public Health*, 22, 7, 95-97.

Salmond, C., King, P., Crampton, P. and Waldegrave, C. (2005). "*A New Zealand Index of Socioeconomic Deprivation for Individuals*," Department of Public Health, Wellington School of Medicine and Health Sciences, University of Otago and The Family Centre Social Policy Research Unit.

Saunders, P., Naidoo, Y. and Griffiths, M. (2007). "Towards New Indicators of Disadvantage: Deprivation and Social exclusion in Australia, " *Social Policy Research Centre*.

Sauvée, L. and Valceschini, E (2003). Agroalimentaire: la qualité au coeur des relation entre agroalimentaire, industriels et distributeurs. *Demeter* 2004,10. Pp 181-226

Savage, L (1972). *The Foundations of Statistics*. Dover (1972 edition), New York, 1954.

Schilderinck, G (2009). Drought cycle management in arid and semi-arid Kenya: A relevant disaster risk reduction model?. Retrieved on October 25th, 2010 from: http://www.ngovoice.org/documents/100-10035b%20-%20FINAL%20DRR%20research%20report.pdf

Stiglitz, J (1989). Imperfect Information in the Product Market. *Handbook of Industrial Organization.* Vol 1 Chapter 11 pp771-807

Tanaka, T., Camerer, C. and Nguyen, Q. (2010). Risk and Time Preferences: Linking Experimental and Household Survey Data from Vietnam. *American Economic Review.* Vol 100 (1) pp 557-571

The World Bank Group (2010), MDGs Retrieved on October 25th, 2010 from http://ddp-ext.worldbank.org/ext/ddpreports/ViewSharedReport?&CF=1&REPORT_ID=1336&REQUEST_TYPE=VIEWADVANCED&HF=N/IDGProfile.asp

Tirole, J. (1988). The Theory of Industrial Organization. MIT Press.

Townsend, P. (1987). "Deprivation," *J Soc Policy*; 16(2):125-46.

Townsend, P. (1979). "*Poverty in the United Kingdom: A survey of Household Resources and Standards of Living*." Harmondsworth: Penguin

Townsend, P., Phillimore, P. and Beattie, A. (1988). "*Health and deprivation: inequality and the North.*" London, Croom Helm.

UNDP (2005). "*Les indicateurs de Suivi de la pauvreté."* Guide pratique pour améliorer les capacités statistiques des responsables politiques pour un suivi efficace des OMD au niveau national.

Walter,B., D'Ambrosio, C. and Vito Peragine (2004). "Deprivation and Social Exclusion," PAC Projet, CIT-2-CT-2004-506084, European Commission.

Wisner, B., Blaikie, P., Cannon, T. and Davis, I (2003): *At Risk: Natural Hazards, People's Vulnerability and Disasters* , (2nd ed) Routledge. London and New York

Yodmani, S (2005) Disaster Risk Management and Vulnerability Reduction: Protecting the Poor. Paper Presented at *The Asia and Pacific Forum on Poverty*. Asian Development Bank

Zinn, J (2006). Recent Development in sociology of Risk and Uncertainty. *Historical Social Research*, vol 31 2006 – No 2, pp275-286

Zupi, M., Estruch-Puertas, E., Driouchi, A. and Izzo, M. (2009). "Social Cohesion Policies in Mediterranean Countries: An Assessment of Instruments and Outcomes. *FEMISE 33-05 200,* 130 pages.