



## “The Valley of Opportunity”: Rethinking Venture Capital for Long-Term Institutional Investors

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## 1. Introduction

Venture capital (VC) investing has been an unsatisfactory experience for many long-term institutional investors (LTIs), such as pension funds and sovereign wealth funds. First, the asset class has not performed in line with expectations for more than a decade. For example, LTIs have invested more money in venture capitalists (VCs) since 1997, in aggregate, than VCs have returned to LTIs over that same period (Mulcahy et al. 2012). Second, there have been few opportunities for newer or slower moving LTIs to access the top (decile) managers that have demonstrated a consistent ability to outperform VC benchmarks. As such, VC as an asset class appears to work only for those LTIs that were first movers into the asset class, such as endowments and family offices. In large part, the challenges associated with this asset class stem from the fact that VC investing is not easy to bring to a scale consistent with the investment objectives of large institutions.

VC is an investment industry characterized by high labor intensity. This stems from the fact that venture investing is largely a services-business founded on ‘high-touch’ interaction with entrepreneurs through trusted (and hard earned) networks of interaction and reciprocity. Further, the best performing VC firms tend to view their roles in terms of business development rather than just an investment. Herein lies the irony of the VC industry: the best performing venture capitalists are capable of helping entrepreneurs scale-up their businesses, but they have not been able to bring scale to their own investment management sector without eroding financial performance (see Mulcahy et al. 2012).<sup>1</sup> In fact, many VCs have stopped trying to grow their businesses, purposely keeping the size of their funds relatively small in order to focus on their core area of expertise: helping entrepreneurs launch and build companies.

This ‘keep-it-small’ mentality, however, means that venture capital has not been able to accommodate the demands of LTIs for opportunities in terms of scale. After all, an allocation of \$10 or \$20 million to a top VC fund would not affect the overall return for a large pension or sovereign fund, even if the underlying VC investment were highly successful. Moreover, spreading a large VC allocation across a large number of asset managers would likely result in an institutional investor paying high fees for beta exposure to what is already an underperforming asset class. This is not desirable. As a result, a growing number of LTIs are disenchanted with the

VC industry. Indeed, public pension funds and sovereign funds have been scaling back their venture capital commitments to external managers and, instead, have been focusing on alternative asset classes that can offer economies of scale, such as real estate, private equity, and infrastructure.

While we understand the reasons LTIs have become disaffected, nonetheless, there is an opportunity for them to re-engage with venture investing in a meaningful way. Consider that over the period, while venture capital returns have been relatively poor, innovation and technological development have not stopped. If anything, the rate of innovation has continued to accelerate, changing the lives of everyday people in meaningful ways.<sup>2</sup> Ultimately, value is still being created through technological innovation, which suggests that VC investing has enormous potential value to the broader community of LTIs. However, if LTIs are to participate in VC in successful ways, they should participate only in niches where they can add value.

There are two broad VC domains in which LTIs can add value. First, there is a compelling case for LTIs to participate in the VC of financial services (e.g., ‘fintech’) and asset management (e.g., seeding). Pensions and sovereigns not only have considerable expertise in these domains, but they also have the capacity to deliver cornerstone clients to the portfolio companies that VC firms are investing in. Second, LTIs should participate in venture investments for which they can serve as an important bridge to commercialization for growth stage companies. Making venture capital work for LTIs, such as pensions and sovereign funds, means finding opportunities where the target companies cannot rely on venture managers alone to reach commercial scale.<sup>3</sup> Clearly this has been the case in capital-intensive industries, such as energy innovation.

In the last decade, VCs added ‘green’ to their traditional staples of ‘IT’ and ‘biotech’ investments. What VCs found in making green investments was that the time horizon to profitability was far longer than they had anticipated. It has been observed that VCs often reached a point where their investee companies’ futures were dependent on finding another set of investors that could ‘take the baton’ forward and develop the ‘green infrastructure’ that is often required for commercial scale. This has been a problem for VCs and ironically, it left many feeling like the entrepreneurs who approach

them: they have been forced to look to other investors to fund their big ideas through to commercial scale. In this sense, the green strategies of VCs have offered LTIs a chance to re-engage with the venture asset class on terms more conducive to their particular interests. In any event, it offers a way to engage the VC industry, particularly in the capital-intensive industries such as energy, materials, food, and water; where the time horizon and scale of LTIs affords the possibility of funding capital-intensive companies from initiation to commercial scale.

In this paper, we suggest that venture capital is a compelling option for LTIs that have the governance procedures and skills to realize such goals. The juxtaposition of large past losses coming from green investments with the potential for enormous future gains presents a challenge to LTIs' capabilities and resources. However, we contend that LTIs can serve as important bridges for venture-backed, capital-intensive companies seeking commercial scale. In turn, LTIs can participate in the success of these companies over the long term. Rather than retreating from the 'valley of death' for capital-intensive companies, this presents a 'valley of opportunity'.<sup>4</sup>

## 2. The 'Valley of Death'

At the earliest stages of launching a company, investors are asked to provide capital to a venture that has no products and sometimes no obvious market for future products. In effect, investors are asked to believe in an entrepreneur's vision for what the company can become and how the company can, in turn, generate acceptable returns. Assuming the entrepreneur secures funding to launch his or her company, it can take years before products come to market and cash flows turn from negative to positive. Before reaching commercial scale, these companies are entirely reliant on external financing to fund operations. This period, long or short, is sometimes referred to as the 'valley of death' (VoD). It is the period in which the vast majority of companies fail (see Gompers and Lerner 2001).

While the VoD is relevant to all companies, those operating in industries with high capital inputs are believed to be particularly vulnerable (see Nanda et al. 2013). In economic terms, the standard J-curve applicable to venture investments in sectors such as energy, food, and water, tend to run deeper and longer than is the case for generic venture investments in industries such as soft-

ware and IT (Mathonet and Mayer 2008). It is perhaps not surprising then that 'green companies' relying on private financing find it difficult to get beyond the VoD (see Murphy and Edwards 2003), as the average green energy venture requires roughly \$500 million from investors before successful commercialization (Hargadon and Kenney 2011). Given that companies only begin to exit the VoD when commercialization starts to take hold and entrepreneurs can demonstrate a clear path to profitability (and steady cash flows), companies in capital-intensive industries are more prone to failure in the VoD than those in less capital-intensive industries.

It is little wonder then that the promise of a 'green revolution,' which was embraced by the VC community over the last decade, has thus far generated so few success stories. In our view, the traditional model of VC does not lend itself as easily to capital-intensive industries, such as energy, as it does to capital-light industries, such as software. A traditional VC firm raises money from individuals and institutions in order to invest in early-stage ventures that are high-risk and have high-expected returns (see Sahlman 1990). Typically, the general partner (GP) raises between \$300 and \$600 million from limited partners (LPs) for an investment fund (see Kenney and Florida, 2000; and Lerner et al. 2007). With this capital, a VC fund will invest in 15 to 30 fledging companies, with initial investments ranging between \$5 and \$15 million. This then allows for as much as \$20 to \$30 million in follow-up funding for the most promising three to five ventures.

By necessity, the large majority of successful venture capital exits have been 'capital-light' (Wiltbank and Boeker 2007). In fact, the most successful venture investments tend to be those where less than \$30 million was invested before commercial scale was achieved and cash flows turned positive. In fact, 79 of the 98 venture-capital backed exits in the 2nd quarter of 2013 were in the capital-light information technology sector (Cruz and Herman 2013). Google is the classic example of a successful capital-light venture; it raised only about \$25 million before its IPO (Vise and Malseed 2006). If we compare Google's path to success to that of Tesla, the automobile company that is the darling of the green movement, it is easy to see the diametrically different cash flow profiles of these two companies. In year seven of operations, Tesla lost \$396 million dollars. Overall, it has lost almost \$1 billion in total. As for Google, it was profitable in year three and generated \$1.4 billion in net

income in year seven (See Figure 1).

While the VC community is renowned for taking fledgling innovations and developing businesses around them (see Gompers and Lerner 1998; Kortum and Lerner 2000; Florida and Kenney 1988; Lerner 2002), this has not held true for capital-intensive green investments. This can be partially attributed to a mediocre IPO market, which has a strong influence on VC returns (Hall 2005). However, poor performance is also the result of fundamental incongruence between the characteristics of capital-intensive green investments and the monetary resources of VC funds. In short, the time horizon and capital intensity of green venture investments has rendered the traditional VC community much less effective at ‘picking winners,’ compared to their past performance with other industries (see Marcus et al. 2013; Kenney 2011; Petkova et al. 2011). To a large extent, VCs have sought to ‘disrupt’ the built infrastructure of our economy without recognizing that enormous pools of capital are required to do so. As such, they have had to rely on other parties and investors to help them bring their capital-intensive portfolio companies to commercial scale. Once again, this left VCs, like their portfolio companies, vulnerable to the VoD.

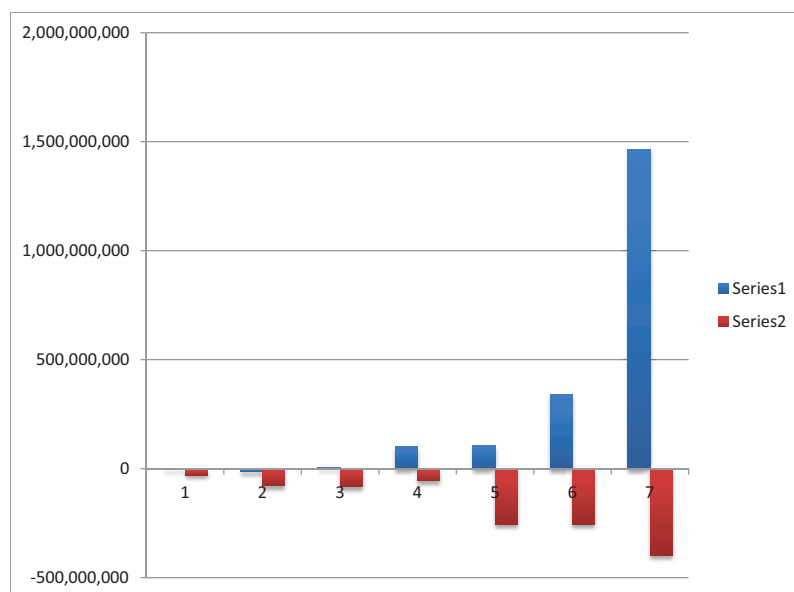
Given the disappointing returns VCs have reaped from green investments over the past decade (especially compared to the remarkable returns in decades prior), many VCs have sought to cultivate additional pools of external capital to help them bring their companies to scale. In general, they have turned to three main sources of

capital for green companies:

**Government:** The U.S. government has traditionally been a key backer of technological innovation, especially at the riskiest levels of IP development. Therefore, many VCs actively cultivate relationships with the government in order to secure funding for their companies, even launching lobbying efforts and participating in government as key advisors. However, in the current political and economic climate, there is little appetite among taxpayers to support governments that seek to pick winners (and also wind up backing losers) by providing loan guarantees to private companies.<sup>5</sup>

**Syndicates of VCs:** Many VCs pooled capital commitments together with their peers for portfolio companies. However, even when deal syndication is successful, as suggested by Lerner (1994) and Lockett and Wright (2001), there can be significant funding gaps for capital-intensive companies seeking to scale-up. Indeed, the most successful cleantech and green energy companies have required a billion dollars or more, which is beyond the reach of even syndicates of VCs.

**Syndicates of Other Investors:** Syndicates of other types of investors can be effective when banks, growth-stage private equity (PE) investors, and project financiers are brought together in a transaction. However, the coordination and management of these disparate investors can be very challenging (see Pease and Westney 2010). Most of these investors bring with them different objective functions and incentives that can derail



**Series 1: Google**  
**Series 2: Tesla**

**Exhibit 1 Tesla and Google Net Income/Net Loss (First Seven Years of Operation)**

the long-term plans of an investee company. Moreover, in an increasingly short-term market (see Aghion et al. 2012; Dallas 2011; Brochet et. al. 2013; Bernstein et al. 2009; World Economic Forum 2012; Kay 2011), most investors view capital-intensive investments as unattractive. In any event, some investors are constrained by their mandates from investing in specific segments, products, or strategies that are not obviously relevant to the green sector; consider that these types of investments often combine aspects of venture capital, private equity, and infrastructure in a single transaction.

### 3. The ‘Valley of Opportunity’

Past failures notwithstanding, it is reasonable to suggest that a select number of capital-intensive ventures will revolutionize antiquated industries by becoming commercially viable and indeed scalable companies in the years ahead. Due to the combined impacts of climate change and resource scarcity, the green economy is almost certainly not just a passing fad. In fact, it is quite possible that a subset of the green energy and technology companies of this generation will go on to be the most profitable companies for generations to come.<sup>6</sup> This juxtaposition of large past losses next to the potential for future gains, we believe, creates a rather interesting opening for LTIs. We call this opening the ‘valley of opportunity.’<sup>7</sup>

The problems that capital-intensive industries create for the VC industry actually serve the interests of LTIs. In fact, we see tangible examples of the LTI community, and in particular pension and sovereign funds, participating as key financiers of innovative companies and projects (with provision of equity and/or debt) that sit between venture capital, private equity, and infrastructure. (See the Innovation Alliance case study in #4.) Yet, in order for LTIs to take advantage of this situation, they need to re-conceptualize the way they access VC opportunities. Too many pensions or sovereign funds want VC to be easy. However, making VC work for LTIs requires far more than writing a check to Sand Hill Road and then crossing fingers. It requires meaningful engagement with the asset class and the companies therein.

Through interviews and case studies, three innovative mechanisms have been identified through which LTIs have sought VC opportunities in a more aligned and scalable manner.<sup>8</sup>

**Direct:** A few institutional investors have brought VC

investing in-house, utilizing their experience in direct private equity and direct infrastructure in order to give effect to direct venture investing in creative ways. One fund that stands out in this regard is the Ontario Municipal Employees Retirement System (OMERS). OMERS has a 14-person investment team responsible for direct VC deals in the USA and Canada. They have made approximately 15 direct investments since launching a couple of years ago, and they have a reputation as one of the “go to VCs” for Canadian entrepreneurs. This is an attractive model. If funds can recruit the necessary talent to run such a program, it can solve the time-horizon problem; OMERS can continue to invest in the portfolio companies as the program expands. It also solves the scale problem, as the winners coming out of the VC portfolio will require ever-larger amounts of capital. Conceivably, the biggest winners coming out of the venture portfolio can be passed into the fund’s public equity portfolios and even handed-off to fixed income teams.

**Seeding:** Some funds have taken to seeding new managers in order to achieve the alignment of interests and scale wanted from the asset class. An example that is relevant is the Wellcome Trust, which recently seeded a \$325 million venture capital business that will back biotechnology startups. The new entity is called Syncona Partners. It has been designed as an “evergreen investment company.” This approach offers many of the benefits of an in-house VC practice, while offering the flexibility required to attract top talent. In addition, this particular vehicle is interesting because it takes advantage of the unique skill set of the Wellcome Trust—a charity entirely focused on health care research. Building a venture practice around health care research enables the Trust to manage asymmetric information and deal flow.

**Creative Collaboration:** Some VCs and LTIs have actively sought to form ongoing relationships with one another. The VCs look to the pension funds and sovereign funds to help bring their most promising companies to market, while the funds look to the VCs to provide a more aligned access point to the asset class than they have had in the past. In addition, these pension and sovereign funds often work with each other in creative ways, recognizing that the success of these collaborative arrangements with GPs will only work if the former can credibly assess the companies presented by the latter.

In all cases, whether it's investing via an in-house portfolio, seeding a new manager, or working with peers and managers in creative ways to support growth-stage companies, LTIs that can find the talent to run a direct or hybrid program can claim access to a remarkable range of opportunities. Among these options, our research has focused upon understanding "creative collaboration." To that point, we offer a case study of this approach, demonstrating how VC can work for LTIs through a real-world example.

#### 4. Case Study: The Innovation Alliance

In late 2012, three sovereign funds signed a memorandum of understanding to jointly invest in growth capital opportunities globally. This group was called the Innovation Alliance ("Alliance") and included the New Zealand Super Fund (NZSF), the Alberta Investment Management Corporation (AIMCo), and the Abu Dhabi Investment Authority (ADIA). The Alliance was established to take advantage of the members' long-term investment horizons, global networks, and large pools of capital to help build companies in capital-starved industries. This was one of the first formal co-investment vehicles created to offer sovereign funds the chance to cherry-pick the best opportunities in top VC portfolios. By committing to the Alliance, members sought to increase their investment options by aligning interests and reducing costs. The Alliance thus represents an investment option (rather than an obligation) for the three SWFs.

**Foundational Beliefs:** In launching the Alliance, the members agreed to a set of investment beliefs relevant to a co-investment platform. These were as follows:

LTIs can use the VoD to their advantage, extracting investor-friendly terms from companies that could one day disrupt energy markets.

LTIs have a unique ability to make a long-term commitment to illiquid investments, resulting in higher returns.

LTIs can pool resources to vet opportunities, an especially important issue since venture capital tends to be a highly technical and non-standard asset class.

LTIs agree that making direct VC investments are risky and expensive; the Alliance, with like-minded and

deeply resourced peers, is an attractive option in terms of facilitating asset diversification.

LTIs believe that forging strategic relationships with best-in-class VC managers could lead to compelling investment opportunities with sustainable, long-term returns.

**Strategy:** The Alliance seeks direct investments in high-quality, late-stage, private, venture-backed companies that are emerging as 'the next big thing' in the energy, food, and water industries. The Alliance will make sizeable commitments (\$50-500M per company of initial and follow-on capital) in a concentrated portfolio of companies (5-10). The Alliance pays no fees.

**Implementation:** One Alliance member has had a close relationship with two top-decile VCs. These VCs were approached to see if a formal collaboration with the Alliance would be agreed. The Alliance was offered unique and privileged access to opportunities. The Alliance solidified these relationships through letters of intent to build companies in industries with high capital requirements, long-term advantages, and market-validated growth. These agreements came with no (explicit or implicit) fees or costs; the VCs and LTIs viewed the arrangement as a division of labor. That is, the VCs de-risk portfolio companies' business models, and the Alliance actively helps the companies achieve commercial scale.

**Administration:** On a semi-annual basis, the Alliance meets in Silicon Valley with its peers and VC partners. There are routine calls among the staff of the Alliance and the VCs to keep abreast of developments in portfolio companies. The Alliance members share costs and expenses for due diligence as well as administration. The Alliance has been kept small (three funds) to ensure effective and efficient execution. The Alliance may add a small number of new partners in the years ahead, based on unanimous agreement among the founders. Investment decisions are made on a case-by-case basis, and Alliance members share the responsibility of the analysis and due diligence.

**Commitment:** The three funds have made in total a notional commitment of \$1 billion to the Alliance. The commitment, even if only notional, was a mechanism to trigger internal resourcing and planning by each fund. To date, the Alliance has deployed over \$450 million directly into 'green' companies.

**Key Success Factors:** What makes this model work is that the LTIs are not naïve about the GPs' motives, even if, in the end, the motives end up being pure. The partnership with the GPs only works if the Alliance has the in-house talent to properly vet the opportunities that the VCs bring. There are serious principal-agent problems in helping VCs salvage their underperforming companies. With this in mind, the three funds decided to team-up, pooling their venture resources into a single cohesive team. Opportunities are run through this team with a focus on executing a rigorous and meticulous evaluation of opportunities.<sup>9</sup> In addition, by focusing on industries that touch upon infrastructure, the three SWFs can utilize their deep expertise in direct infrastructure investments. This has also been critical in vetting some of the opportunities presented to the Alliance. To date, this creative collaboration amongst peers and GPs has been rewarding. Nonetheless, given the time frame, the investment program has many years to run.

## 5. Lessons Learned

In this section, we distill the lessons learned from our case studies and experience working with LTIs looking to take advantage of the valley of opportunity. Here, we set out the principles and policies that LTIs should consider when reviewing (or managing the process of) investing in capital-intensive ventures. Readers will notice that the principles below highlight the cultural and theoretical challenges facing LTIs, while the policies focus on resolving operational and implementation challenges.

### 5.1 Principles

Making direct venture investments means asking LTIs to step outside of their comfort zones. The nature of the risks embedded in small capital-intensive companies places them beyond the reach of traditional investors. As such, various cultural and organizational adjustments may be required for institutional investors to be successful in financing green innovations. The following principles are deemed fundamental for LTIs investing in green VC opportunities:<sup>10</sup>

**Responsibility:** The most challenging cultural issues facing LTIs are, ironically, the need to take more responsibility for, and ownership of, the investments in their portfolio. Typically, institutional investors work through a long chain of intermediaries before their cap-

ital is actually deployed in companies (see Colombo and Grilli 2010; Gillan and Starks 2003; Levich et al. 1999). While intermediation may make an allocator's job relatively easy, it also serves to neuter the competitive advantages of LTIs in this domain. Investing via external asset managers serves to shrink the time-horizon of the investment decision-making and distort the incentives and objectives of the ultimate asset owners (Clark and Monk 2013a; Clark and Monk 2013b). In short, LTIs need to be willing and able to make direct investments in green companies, which means they have to build in-house teams and capability. In this regard, governance is critical (see Clark and Urwin 2008; Marathon Club 2007).

**Theory:** For investors relying on conventional portfolio and investment theories, it can be very hard to justify growth stage investing in green companies. As such, LTIs may have to go beyond the tenets of modern portfolio theory, as modern portfolio theory will not be able to capture and articulate the value of these long-horizon innovations. In large part, this stems from the fact that truly game-changing technologies create new industries, not just new firms. Entrepreneur(s) have to build a whole set of vendors and suppliers to help the company scale-up. Thus, the rigid metrics of modern portfolio theory are not easily applied to these ventures, as modern portfolio theory does not take into account future increased earnings stemming from the opportunities to capture value along the path of building an entire industry (see Müller 1988; Elton et al. 2009). Therefore, LTIs have begun to use a hybrid model that combines venture capital style assessment with more traditional PE and infrastructure metrics (see Baum and Silverman 2004).

**Risk:** When it comes to green ventures, LTIs have to adopt a different belief system about risk. In all likelihood, cash flows do not yet exist on a level that justifies existing valuations (see Bürer and Wüstenhagen 2009; Horwitch and Mulloth 2010), especially when compared to comparable companies in other industries (see Gompers and Metrick 2001; McConnell and Servaes 1990). What is required is an ability to look beyond risk and focus on 'what's possible'; LTIs must view risks in a similar manner to venture capitalists (see Moore and Wüstenhagen 2004). This qualitative and subjective framing leaves many LTIs uncomfortable. Nonetheless, it is required when investing in companies like Amazon, which required enormous financial backing before

finally turning a profit (due to the infrastructure that had to be built by the firm before profitability). Note that qualitative judgment need not imply a lack of rigor. Rather, it implies bottom-up analysis and in-depth due diligence. This is an approach that requires more discipline than some of the more traditional top-down models of investment decision-making.

**Engagement:** It is crucial that LTIs recognize the importance and value of their engagement in portfolio companies. Many target companies view the manner in which institutional investors add value to be more critical than the cost of capital (Bygrave and Timmons 1992). While LTIs believe that they have little value to add, there are various ways of assisting in commercialization. Since LTIs have a large network of peers, LTIs can provide introductions to peers that can provide cash injections, reducing the need to be in a continuous fund-raising mode. The LTIs can also provide introductions to potential customers and vendors. Critically, LTIs can provide support and capital to help with transformations similar to those articulated by Christensen (1987) in *The Innovator's Dilemma*. Often initial business models need to be changed for businesses to remain competitive. Both VCs and LTIs can add value at different stages of a venture's lifespan.

## 5.2 Policies

The following operational and strategic factors are deemed to be important for all LTIs looking at this type of investing:

**Direct Investing:** In order for LTIs to be active and engaged in their investments and to have the capability to assess which green ventures have the most promise, LTIs need organizational and human resources that match-up against even the most sophisticated growth-stage investors. This implies the presence of strong in-house management and deliberate efforts to recruit and retain qualified staff and advisors (see Bachher and Monk 2013). The creative collaboration model, which brings LTIs together with VCs, only works when the LTIs are proactive and not naïve about the GPs' motives. This means LTIs need the requisite in-house talent.

**External Partnerships:** VCs often fail to maintain interest alignment and deliver adequate returns to LPs (see Mulcahy et al. 2012; Sensoy et al. 2013; Cumming and Johan 2009). Still, the specialized knowledge of VCs

is difficult to replicate in-house, which means that VCs have an important role to play in the investment process. As such, LTIs tend to develop a handful of relationships with VCs so as to source direct deals in green companies. In some cases, LTIs become “partners” with VCs rather than competitors.

**Trusted Peers:** Since it is difficult to build investment capabilities in-house, collaborative vehicles that bring direct investors together are also required. As noted above, collaborative vehicles can help long-term investors mobilize the resources and capabilities necessary to judge which green opportunities are, in fact, commercially viable over the long term. Syndicating deals among LTIs allows these organizations access to a broad array of talent, insight, and expertise. Because some of these investments will fail, pension and sovereign funds are best served by pooling capital with other like-minded investors to capture the benefits of diversification. The LTIs we have studied have screened green opportunities through the collaborative team and have focused on executing a rigorous and meticulous evaluation of opportunities.

## 6. Conclusions

Venture capital has been out of favor for the past decade among the largest institutional investors in the world. Much of this stems from the poor returns generated by external managers, as the large majority of VC funds have not out-performed public markets. A majority of VC funds have failed to even return investors' capital. As a result, many LTIs have scaled back their VC commitments to external managers and, instead, have focused on alternative asset classes that can offer economies of scale such as private equity, infrastructure, or real estate. In this paper, however, we have argued that VC still offers remarkable opportunities for well-positioned institutional investors.

Indeed, there is a unique opportunity for LTIs to carry venture-backed, capital-intensive companies to commercial scale and, in turn, participate in their success over the long term. Rather than a valley of death (VoD) for these companies, we see a valley of opportunity: the juxtaposition of large past losses from green investments with the potential for future gains presents an important investment opportunity for long-term investors. However, in order for LTIs to take advantage of this opportunity, they need to re-conceptualize the way they access VC opportunities. Thus far, the creative



collaborations have functioned effectively. But it is still early days, and the true value of these relationships may not be known for years to come.

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### Endnotes

1. Size of a fund has been shown to influence performance over the long term (see Kaplan and Schoar 2005; Phalippou 2010).

2. Consider the examples of the iPhone®, iPad®, Facebook®, Android, Kindle®, Electric Car, Twitter®, and applications of all kinds.

3. In 2008, the traditional partners of VC GPs, such as endowments, demonstrated an inability to participate in co-investments due to liquidity constraints. This has opened up the opportunity to other long-term investors such as pension and sovereign funds.

4. This is based upon case studies with predetermined interview questions, as described by Richards and Morse (2006). As suggested by Clark (1998), we have granted anonymity to the people and the firms that have agreed to participate. We have also used a method called triangulation in which we back-up the ideas addressed by the interviewees with previous literature, news articles, and case studies; see Jick (1979) and Morse (1991).

5. The Obama Administration was embroiled in controversy over its \$535 million loan guarantee given to the now bankrupt solar company Solyndra. The House Oversight Committee accused the U.S. Department of Energy of negligence and mismanagement in a Staff Report (2012). This has resulted in declining government support for capital-intensive green company initiatives;

see Cahoy (2012).

6. A recent German government-sponsored study projected that the cleantech industry would be valued at as much as \$5.8 trillion by 2025 (Dembicki 2012).

7. Institutional investors (LTIs) are, in theory, well suited to the characteristics of capital-intensive venture investments (see Graves and Waddock 1990; Bushee 1998; Hartzell and Starks 2003; Dahlquist and Robertson 2001). For example, the time to commercialization of a typical green energy investment aligns quite well with the time horizon of pension funds and sovereign funds. In addition, the scale of investment required for a green company to commercialize fits reasonably into an institutional investors' set of resources. In fact, most LTIs don't even want to spend time and resources on investments under \$50 million due to their own resourcing and needs.

8. Doing direct investments in venture stage companies within a public fund requires high levels of buy-in and understanding by the Board. Some of the investments will, inevitably, go to zero. In our view, that is simply the nature of the asset class. Boards need to understand this and be prepared for the possible negative and positive consequences of VC investment.

9. The Alliance has also routinely tapped Dr. Monk's colleagues at Stanford and Oxford universities to serve as expert consultants during due diligence.

10. Embedded in these principles is the economic theory of differentiation (see Krugman 1998; Buckley and Ghauri 2004). Economic differentiation states that in different industries, finance is required to serve dramatically different roles. Institutional investors have wide-ranging investments in many different industries (Schneeweiss and Georgiev 2002), making it challenging for the achievement of differentiation among strategies. However, this is what's required when focusing on "green" venture capital.

11. In order to make such risky investments, LTIs should develop risk budgets, such that these high-risk investments do not put a strain on the entire portfolio. Since disruptive companies have considerable idiosyncratic risk, these risks can be managed through diversification (see Campbell et al. 2001; Goyal and Santa-Clara 2003).

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