A strategic view on smart city technology: The case of IBM Smarter Cities during a recession

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ABSTRACT

Could smart city technology be considered as a strategic option for firms, especially in recession conditions? Most prior smart city studies focus on the nature and impact of technological systems adopted in the context of particular urban conditions. At the same time, studies about recessions examine primarily their reasons and consequences. Currently, there is no research examining the role of city technology as a strategic option for firms in a recession environment. To address this gap we develop a conceptual framework from studies of recessions and examine the case study of the IBM Smarter Cities initiative against this framework. Our case builds on interview and archival data. Our study offers two contributions. First, we offer an empirical examination of city technology from the perspective of stakeholders and actors who are tasked with the role to create and disseminate these technologies instead of the perspective of cities that use the technology. Second, we propose a strategic view to city technology and showcase the distinctive theoretical and empirical insights that future studies can develop by shifting the attention on the processes and practices inside the ICT organisations creating and disseminating these city technologies.

"It is important to understand IBM's long term model. We are an innovation company… In 2012, this model produced solid results. Your company continued to outperform our industry and the market at large… In the five years since its launch, the goal of building a Smarter Planet has had a transformational impact…[it] is not only driving growth, but also speaking to IBMers' aspiration to be essential to each of our vital constituencies." Statement to stockholders on 30 April 2013 by Virginia (Ginni) Rometty, Chairman, President and Chief Executive Officer, IBM [55].

1. Introduction

The purpose of this paper is to develop a strategic view on smart city technology for Information Communications and Technology (ICT) firms, particularly in conditions of economic recession. Fuelled by the collapse of the financial sector, in 2008 the UK entered its deepest and longest recession of recent times. With a 6% output drop at its depth and strong dependence on its troubled financial industry, it may take several years before the economy recovers to pre-recession levels, possibly rivalling the recovery from the 1930s Great Depression. In this context, it is timely to ask whether smart cities as a concept and initiative can actually form the basis for a strategic response to a recession. This paper takes on this challenge and begins by reviewing studies about recessions and company responses to them. We find that few studies have focused on what constitutes an appropriate business response [29,54] during a recession. We also outline the way smart city technology has been examined in the literature. Our review reveals that we have limited understanding of the role of smart city technology as a strategic option during recessions. In order to address this gap in the literature, we examine smart city technology as a strategic option using the case study of IBM's "Smarter Cities" within one of the firm's business units in a period of recession (2008–2009).

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IBM's Global Business Services (GBS) provides IT consulting services and application development, management and outsourcing services. The aim of GBS is to deliver business value and innovation to clients through solutions that leverage industry- and business-process expertise. The empirical context of this paper takes place within the UK and Ireland (UK&I) region. IBM has created eleven strategic Smarter Planet themes globally [24]. This paper considers the adoption of one of these themes: Smarter Cities, which addresses congestion, pollution, health, safety, sustainability, energy use and water management in IBM GBS UK&I.

The Smarter Cities initiative in IBM started in late 2008 [21] as part of the firm's Smarter Planet initiative: its vision is of a planet that is more instrumented, interconnected and intelligent. IBM's performance from 2008 to 2012 has led analysts to declare that it has managed to avoid the cyclical swings in the technology business, with earnings, gross margins and earnings per share improving steadily throughout the recession [33]. In the second quarter of 2012, revenue from Smarter Planet projects increased more than 20% [33]. More recently, in Q1 2013, IBM reported that Smarter Planet revenue rose more than 25% and announced that Smarter Planet, together with Big Data analytics, cloud computing, emerging growth markets, will account for $20 billion in incremental revenue from 2011 through 2015 [13]. Based on the annual reports for 2008–2012, IBM's gross margin for Global Business Services (the part of IBM that the Smarter Cities initiative fits within) has increased from 27% to 30% over that period. This background makes IBM an ideal case to study the smart cities technology strategy in more depth. For our data collection, we interviewed IBM's leaders, strategy consultants and marketing specialists, including those in the UK and in IBM's corporate team. We triangulated this interview data with extensive archival evidence. Our findings offer a novel conceptualization of smarter cities, not only as a technical solution but also as a strategic one, particularly in recession conditions. Such approach, as we will argue next, is missing from extant organisational and technology literatures.

2. Theory

2.1. Perspectives on smart cities

The term smart cities[1] as Harrison and Donnelly [21] note is not new and has been used by global technology firms, particularly since 2005 for "the application of complex information systems to integrate the operation of urban infrastructure
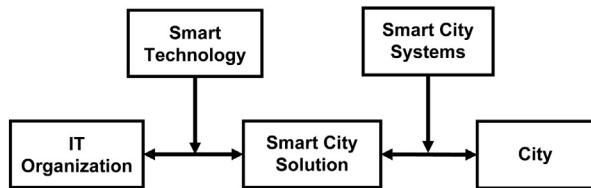

Fig. 1. The technology and primary stakeholders in a smart city.

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[1] We use the term smart cities and smarter cities interchangeably in this paper.

Table 1
Empirical studies offering strategic actions during a recession.

	[51,52]	[27]	[45]	[49]	Clifford (1977)
Strategic focus					
Focus on small set of core values	✔				
Continuously survey external conditions	✔				
Selective market positioning, diversify or position in less vulnerable multiple markets			✔		✔
Acquire selected new businesses	✔	✔	✔		
Divest business segments that underperform		✔		✔	
Market orientation					
Agile positioning & increased promotion of products & services.			✔	✔	✔
Listen to customers; invest in relationships				✔	
Disciplined value-pricing strategies; cut prices with caution & pass on cost increases		✔		✔	✔
Financial					
Increase financial efficiency		✔			✔
Focus on revenue growth, market share		✔	✔		
Operational					
Innovate & introduce new products that meet strategic and financial goals		✔	✔	✔	✔
Retire unprofitable products					✔
Increase operational efficiency		✔			
Workforce					
Develop human capital & communications			✔	✔	✔
Be innovative in reward & recognition					✔
Lead by example & encourage others to do the same: take initiative & reasonable risks; accept mistakes					✔
Remove underperformers				✔	
Invest in training & spotting talent			✔	✔	
Decision-making					
Act quickly without overreacting		✔		✔	
Take time to evaluate and think				✔	
Make informed, data-driven a fall-back plan if sales decline		✔	✔		
During recovery, grow in a controlled manner		✔			

and services such as buildings, transportation, electrical and water distribution, and public safety" (2011: 2). An example of a Smarter City solution would be one that tackles the problem of insecure and unsustainable energy sources. By allowing consumers and energy providers to share dynamic price and consumption information in real time, energy production would be more efficient [32]. This has been trialled in Seattle,

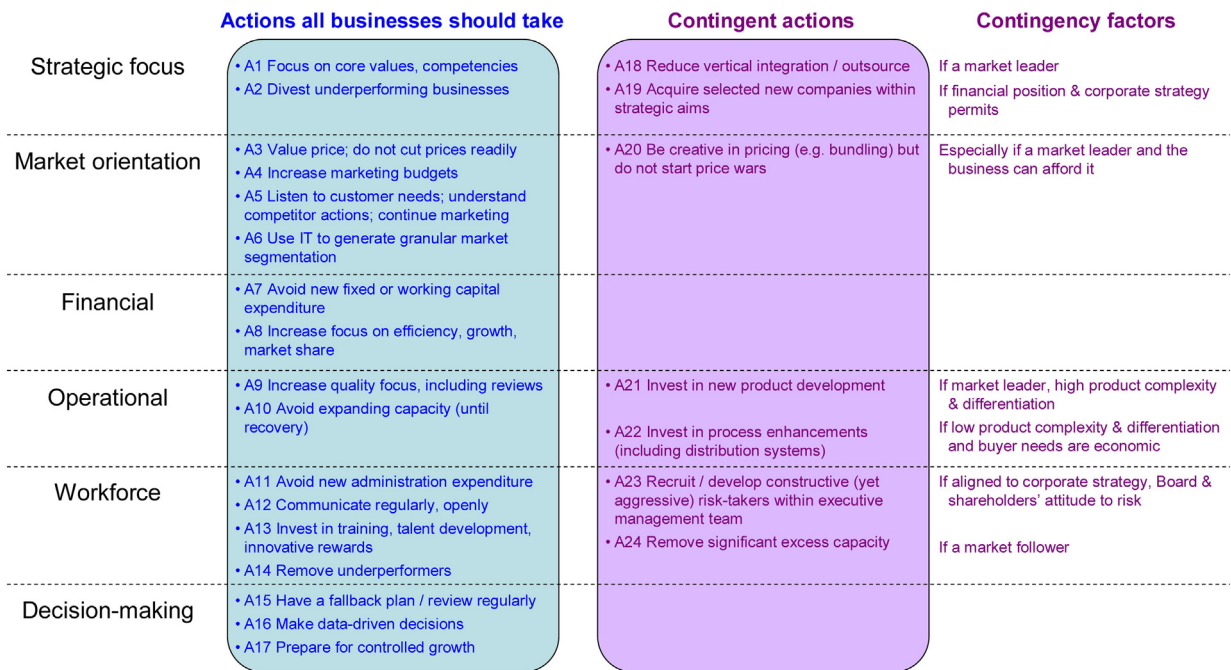|	Actions all businesses should take	Contingent actions	Contingency factors
Strategic focus	• A1 Focus on core values, competencies • A2 Divest underperforming businesses	• A18 Reduce vertical integration / outsource • A19 Acquire selected new companies within strategic aims	If a market leader If financial position & corporate strategy permits
Market orientation	• A3 Value price; do not cut prices readily • A4 Increase marketing budgets • A5 Listen to customer needs; understand competitor actions; continue marketing • A6 Use IT to generate granular market segmentation	• A20 Be creative in pricing (e.g. bundling) but do not start price wars	Especially if a market leader and the business can afford it
Financial	• A7 Avoid new fixed or working capital expenditure • A8 Increase focus on efficiency, growth, market share		
Operational	• A9 Increase quality focus, including reviews • A10 Avoid expanding capacity (until recovery)	• A21 Invest in new product development • A22 Invest in process enhancements (including distribution systems)	If market leader, high product complexity & differentiation If low product complexity & differentiation and buyer needs are economic
Workforce	• A11 Avoid new administration expenditure • A12 Communicate regularly, openly • A13 Invest in training, talent development, innovative rewards • A14 Remove underperformers	• A23 Recruit / develop constructive (yet aggressive) risk-takers within executive management team • A24 Remove significant excess capacity	If aligned to corporate strategy, Board & shareholders' attitude to risk If a market follower
Decision-making	• A15 Have a fallback plan / review regularly • A16 Make data-driven decisions • A17 Prepare for controlled growth		

Fig. 2. Strategic recession action framework.

where energy bills dropped by 10% on average and stress on the grid reduced by 15% [15].

Our review demonstrates that most smart cities studies focus on the features of the technology adopted to solve particular urban issues [31], while others adopt a systems perspective to consider cities as complex systems that are prone to particular behaviours such as adaptation and self-organisation [2,48]. Motivated by these distinctions in the literature, we can identify two key stakeholders: the city that adopts the smart city solution and the ICT organisation that develops and delivers the city technology solution (refer to Fig. 1). We argue that, up to now, while most researchers tend to focus on the right-hand side of Fig. 1, our study proposes a novel approach and focuses on the ICT organisation providing the particular city technology solution. The context of our investigation is the economic conditions of a recession.

2.2. Strategies during recession: towards a recession action framework

Despite the general consensus that the United Kingdom and global economies plunged into recession during 2008, a single definition of what constitutes a recession does not exist in extant literature. Analysts often define a recession to be when a country's real (inflation-adjusted) national Gross Domestic Product declines for two or more successive quarters [12]. There are other periods when the UK economy was virtually in recession, which this definition excludes, due to the fluctuating nature of GDP growth. For example, in 1956, the average growth over three quarters was −0.6%; however, as there was zero growth in the middle period, this does not constitute a recession. A recession might also be defined as a period when a country's real annual GDP growth is negative.

A number of studies have examined the types of strategies companies could adopt during a recession [29,58,59]. In following a *retrenchment strategy*, a business focuses on how it can have the best chance of meeting its short-term financial obligations, by minimising its expenditure. [53] cite much evidence in support of retrenchment being the first step of a turnaround strategy. The expectation is that this strategy enables the business to survive the difficult economic conditions. Initial cost-saving measures usually focus on non-essential expenditure, while expenditure on areas such as travel, training and discretionary rewards is minimised. The workforce measures tend also to be implemented, including redundancies, incentivised early retirement, salary freezes or other ways of reducing salary costs [56]. In the current recession, strategies include incentivised sabbaticals, businesses only paying staff for 4 out of 5 working days (e.g. KPMG: [7]) or businesses asking staff to work for free (e.g. British Airways: [8]).

Alternatively during a recession, firms may choose to be more entrepreneurial, by adopting an *investment strategy*. By taking a longer-term view, the business considers recession as an opportunity to strengthen its competitive advantage and position itself for future economic recovery [27,29,45,50–52]. Investments may include process improvements, restructuring, training or R&D and a business may undertake these at the expense of production activities. Several factors contribute to the degree with which a business invests proactively in marketing during a recession [65]. Although advertising expenditure commonly decreases during a recession [46], it is argued that businesses should increase marketing and customer focus [49], especially if focused on the core business [44]. By reinforcing its brand image or even changing its position subtly (by focusing on product traits important during recession, such as value or cost efficiency), businesses hope they can drive up (or maintain) demand levels

Table 2
Performance indicators and smart city approaches during a recession (financial data based on 2009 annual reports).

Performance indicators and responses	Cities growth strategy
Siemens	
• Fourth quarter sales down 16%; revenue down 9% and 25% profit increase	• Vision for energy efficiency & distributed, autonomous IT systems
• Redundancies and 4-day week in Cheshire (early 2009) has partially been reversed [61]	• Investment in City of the Future and Centre of Competence for city management
	• Acquisitions of sensor and public infrastructure companies; joint working with Nokia, Fujitsu
	• Solution core is urbanisation and sustainable development [63]; investment in building, water, energy, traffic technologies
GE	
• Lowest stock price for 12 years; 2Q 2009 profits halved and dividends cut for the first time since the Great Depression [25]	• 'Ecomagination' vision: sustainability through energy, water, transportation and utilities
• Change in strategic focus towards cheaper, simpler products [37]	• Solutions focused on infrastructure leadership combined with alliances with Google, Cisco (Smart Grid), Intel (healthcare); joint venture with Mubadala for energy research [17]
	• Energy solutions in Oklahoma and Masdar (first carbon-neutral city)
Accenture	
• Declining 2009 revenue (11%), yet increased bookings	• Launch of the Intelligent City Network to bring visionary city clients together; Global City Forum to establish public view of the role of government [1]
• UK reputational damage due to troubled NHS and Centrica contracts [28]	• Identification of city challenges; with focus on mobility, energy and buildings
• Plan to grow headcount by 25% in 2010	• Smart grid focused on communications infrastructure
	• Boulder partnership: the nation's first fully integrated Smart grid community
Cisco	
• First quarter 2010 sales down 13%; net income down 19%	• 'Smart + Connected Communities' vision of the network as the fourth utility to integrate cities
• 2000 job losses in 2009 [3]	• Innovative engagements include Malaysia's i-City (involving a centrally-controlled monitoring IP network in every building) and collaborative energy solutions in San Francisco and Miami
• Expansion into security through $183 m acquisition of ScanSafe	• Development principles: energy reduction, energy efficiencies from broadband, pervasive infrastructure and data/process integration
Microsoft	
• Fourth quarter revenue down 17% and operating income down 30%	• Vision: embedded Microsoft technologies in the city infrastructure
	• Aggressive partner strategy favouring NGOs, government and educational organisations
	• Software solutions include Citizen Service Platform and Connected Government Framework to support government focus on cost and efficiency [35,36]
HP	
• 4Q 2009 revenue down 8%	• 'City 2.0' vision: the city is an IT infrastructure for increased sustainability and energy efficiency with the data centre as a core
• Adopting bundling marketing strategy to attract volume sales [11] Reduction in employees' base pay of between 5 and 20% and 850 UK job losses [34]	• Long-standing partnerships with Accenture and Cisco in public sector engagements and solutions investments
	• Implementing solutions (e.g. in Leeds) with business value measured in energy efficiency,
Google	
• Third quarter results up 7%; net income up 27%	• Vision: 'to organise the world's information and make it universally accessible and useful'
• 200 job cuts in 2009 [22]	• Offerings based on health, open platform power metres, 3D models, Google Earth/Maps
• Strategy to continue investing, particularly in acquisitions [38]	• Partnerships: GE and Smart Grid conference
	• 'RE < C' programme to develop renewable energy cheaper than coal [19]

and be less impacted by the recession. This can be difficult as changing environmental factors, customers' buying psychology and internal pressures to cut marketing budgets all make it difficult to develop an appropriate strategy [18,50]. Another way of increasing demand is to discount prices, although this carries the risk of creating an aggressive price war. Instead, businesses could seek alternatives to price cuts such as bundling [45]. A business may utilize spare capacity and prepare for future recovery by investing in the development of new products or services it believes it can sell when the market starts growing again [49].

In the long-term, retrenchment and investment strategies provide different outlooks. The latter yields high growth and the former yields further challenges as postponed investments amplify or prolong the negative effects from recession. Another approach is to reposition. The business builds a portfolio map and compares the market growth rate with the business's relative market share. This can be done with sophisticated IT technologies at very granular level [6]. Taking a granular view minimises the masking effects of aggregate performance. [6] also advocate cutting costs discriminately during a downturn i.e. protecting those areas of the business that are performing well from indiscriminate cost cutting across the entire business. Successful businesses may adopt both retrenchment and investment measures at different times, to not only survive the recession, but take advantage of the opportunity it provides. In this *ambidextrous strategy*, the degree with which one strategy is adopted in preference to the other depends on the attitude to risk from the senior leadership team and the stage of the business cycle [29]. A retrenchment approach may be more

Table 3
Details of the interviews conducted.

Levels	Comments	Interviewee & role	Format
A. Corporate HQ	IBM's Smarter Planet themes originated from the corporate marketing level in IBM's HQ in the US. People from this level have a vision on the strategy, its place in the global economy and the basis on which it was derived.	Vice president, marketing and communications	Telephone
		Market insights professional	Telephone
B. UK&I strategy leaders	Responsible for IBM UK's strategy. Some have a broader remit than the GBS business; they have a perspective on the UK marketplace and localisation of the corporate Smarter Cities strategy.	UK&I strategy lead	Face-to-face
		GBS growth programme director	Face-to-face
C. UK&I business leader	Responsible for running a segment of IBM's business. Their objectives are to win a profitable new business and grow market share. They have a direct interest in whether IBM's strategy drives enhanced business results in this economic climate.	GBS public sector lead	Face-to-face
D. UK&I Smarter Cities implementation team	This team is responsible for implementing the Smarter Cities strategy within GBS UK&I.	Consultant	Face-to-face
		Local government marketing manager	Face-to-face
		Implementation project manager	Face-to-face
		GBS marketing manager	Face-to-face

effective during the early stages of a recession, yet an investment approach will be most effective during recovery [14].

Overall, our review reveals that no single strategic action provides the silver bullet to position a business best for survival and growth in a recession. Instead, most authors suggest that businesses should combine several actions to maximise performance. Table 1 summarises the empirical studies that offer recommendations for specific strategic actions in a recession. We have excluded several 'recipes for success' articles in applied journals as they were not based on rigorous analysis of extensive datasets. Our review shows that there are common themes within the literature (e.g. workforce focus), although the precise recommendations tend to vary across the papers. The strongest themes are associated with increased innovation, acquisition strategy, workforce development and market orientation, suggesting that a blend of investment actions positions a business best during recession, albeit with appropriate cost-cutting.

Another insight from Table 1 is that studies with a contingency focus are scarce; with most authors arguing or implying that their particular theoretical focus (e.g. increased marketing) or action list is applicable universally. Yet, in a highly turbulent environment a business is likely to adopt a retrenchment strategy in response to a crisis [64]. Conversely, a simple, familiar environment that can be influenced encourages an investment strategy. Roberts [54] considered whether the most appropriate strategy depends on certain factors, based on evidence from 1000 businesses worldwide. He quantified the performance impact of strategic actions taken by a business during recession in terms of profitability (return on capital employed) and post-recovery measures (profitability and market share gain) relative to companies that maintain pre-recession activity. The key results from this are: 'Good Costs' during recession are marketing, quality, and product development. Investment in these has a short-term impact on profitability, yet enhances competitive advantage during recovery and post-recession. Similarly, cutting investment costs reduces profit and market share growth during recovery from recession. 'Bad Costs' during recession are fixed/working capital, manufacturing and administration. Investment in these areas does not improve profitability during or post-recession and generally introduces additional costs in resolving initial problems with equipment and consequences on quality, reputation and price. 'Dependent Costs' during recession are outsourcing, price aggression and retention of spare capacity. Increased vertical integration has a negative impact for businesses during recession, recovery and post-recession. Similarly, reducing vertical integration (or increased outsourcing) has a greater effect during recovery for market followers (increasing profit) and post-recession for market leaders (increasing market share). Hence, a recession provides a good opportunity for businesses to outsource and restructure. The findings provide guidance on the impact of strategies during recession. However, as services businesses only account for approximately 8% of this sample, hence care must be taken in interpreting results in a services environment.

Overall, our review shows a range of approaches about what constitutes an appropriate strategic response during a recession. Based on this review (refer to Table 1), we propose the Strategic Recession Action Framework (SRAF) in Fig. 2 that outlines actions (A1–17) that all companies can take during a recession and actions (A18–A24) that depend on factors such as market position, risk aversion, financial strength, product complexity and buyer needs. These actions relate to outsourcing, acquisition, workforce development and R&D investment. In this paper, our effort is to investigate whether adopting a Smart Cities technology strategy follows this framework.

As explained earlier, we examine Smart City technologies from the perspective of the ICT firms who act as providers of these solutions. These firms are tasked by city councils to design and deliver customised technological solutions. In Table 2 we summarise the use of the smart cities terminology by most of these global ICT firms. Importantly we also present the performance indicators (Table 2) and key decisions these firms took around these technologies during the recent recession in 2009. In the context of an economic recession, it is then interesting to ask whether the adoption of smart cities technologies aligns with the strategic recession action framework we presented earlier. As we explained in our introduction, due to its

Table 4
Assessment of IBM UK&I Smarter Cities using the recession action framework.

Action area	Summary assessment	Evidence from our case analysis and indicative quotes
Strategic focus		
A1 Focus on core values, competencies	Medium–high	Strategy is largely based on core values of innovation, industry insight and complex programme management. "It is in our DNA to bring clients and the world innovation"
A2 Divest underperforming businesses	N/A	The Smarter Cities strategy is in its infancy. Opportunities are only pursued if they have potential; however, it is too early to see IBM's response in the event that these underperform.
A18 Reduce vertical integration/outsource [if a market leader]	Medium–high	Outside of the Smarter Cities implementation, IBM UK&I has high focus on outsourcing or offshoring where relevant for non-core business services.
A19 Acquire selected new companies within strategic aims [if financial position & corporate strategy permits]	Low	Very limited acquisition is taking place. Where necessary, resources and skills are targeted to grow specific capabilities or for knowledge. IBM's approach with this strategy is to partner where possible. "Success with this strategy is in developing relationships and opportunities for problem solving."
Market orientation		
A3 Value price; do not cut prices readily	High	IBM aims to seek high value opportunities, which attract higher profitability. "IBM can charge a premium if we bring something unique to clients."
A4 Increase marketing budgets	Medium	Overall, marketing budgets have remained constant. However, the amount available to solution-based strategies such as Smarter Cities has increased. "We have plans for innovative events."
A5 Listen to customer needs; understand competitor actions; continue marketing	Medium–high	This strategy has been developed by considering customer needs, using market intelligence and customer feedback. Within the UK, consideration is given to UK&I cities' needs; however, a greater understanding could be sought. "Of all recent IBM strategies, this has taken the greatest step in the right direction towards listening to client needs." A reasonable understanding exists (greater at the global level) of competitor actions.
A6 Use IT to generate granular market segmentation	Medium	Market segmentation is relatively high: done at a city level. However, given the high number of potential client organisations in each city, there is scope for segmenting the market further. This could be done at the city component level. "Cities are competing with each other. They want to establish appealing identities. Selection of cities to target is based on those with a vision."
A20 Be creative in pricing (e.g. bundling) but do not start price wars [if a market leader and the business can afford it]	Medium	IBM is not initiating a price war. Some creativity could be applied to attract new clients, in terms of services offered for the same price.
Financial		
A7 Avoid new fixed or working capital expenditure	High	IBM is not investing in increased fixed or working capital expenditure.
A8 Increase focus on efficiency, growth, market share	Medium	The UK&I Smarter Cities value proposition has a high focus on helping clients to achieve efficiencies. A similar internal consideration is needed to ensure IBM achieves efficiencies with its own team. With the Smarter Cities strategy, strong focus is on profitable growth and market share, as the strategy is targeted towards attracting new clients.
Operational		
A9 Increase quality focus, including reviews	N/A	Insufficient evidence obtained.
A10 Avoid expanding capacity (until recovery)	High	IBM UK is only taking on small numbers of new hires (and with targeted skill sets).
A21 Invest in new product development [if a market leader, high product complexity & differentiation]	Medium	Limited investment is in targeted solutions to support specific Smarter Cities themes. This comprises a mix of new solutions and re-use of existing offerings: "Social network analysis techniques could be used to create a map for clients to help with their decision making and for a city, determine the sphere of influence for a given organisation" "Every Smarter Cities engagement is custom [unique]. IBM's solution investment is focused at the component level."
A22 Invest in process enhancements (including distribution systems) [If low product complexity & differentiation and buyer needs are economic]	N/A	Services offered under this theme have high complexity. Buyer needs are more value-driven than purely economic.
Workforce		
A11 Avoid new administration expenditure	Medium–high	No new administration expenditure is occurring.
A12 Communicate regularly, openly	Low–medium	The global Smarter Cities and Smarter Planet themes are communicated to the workforce regularly and openly. The UK Smarter

Table 4 (*continued*)

Action area	Summary assessment	Evidence from our case analysis and indicative quotes
A13 Invest in training, talent development, innovative rewards	Low–medium	Cities strategy is still in its infancy and once it has stabilised, high-profile communication will be needed. Skills gaps have been identified and targeted hiring is in place. However, large-scale training in this strategy is not planned. Focus on skills relevant to this strategy is required: those relating to selling and developing the Smarter Cities vision successfully.
A14 Remove underperformers	Medium	Limited information available; however, there is a high focus on managing performance of lower performers.
A23 Recruit/develop constructive (yet aggressive) risk-takers within executive management team [If aligned to corporate strategy, Board & shareholders' attitude to risk]	Medium	The Smarter Cities strategy targets new customers. This carries risk as it may not yield returns. There is little evidence of additional risk-takers being recruited into executive roles specifically for this strategy or as a result of recession.
A24 Remove significant excess capacity [if a market follower]	Medium	IBM is a market leader, so not applicable. However, outside of the Smarter Cities strategy, IBM UK reviews excess capacity and various schemes have been put in place to offer employees the opportunity to work in growth markets or on overseas projects, thus removing (temporarily) excess capacity.
Decision-making		
A15 Have a fallback plan/review regularly	Low–medium	Measurement criteria are being developed. A governance structure has been initiated and this will be an appropriate place to review progress.
A16 Make data-driven decisions	Low–medium	Decisions are made by selecting cities with a vision and without an incumbent supplier. More data is needed to objectively assess the attractiveness of each opportunity.
A17 Prepare for controlled growth	Medium–high	Initial implementation plans are targeted and controlled. The implementation team are focusing on a small number of opportunities, enabling controlled growth.

performance, IBM represents a suitable case study to examine this question.

3. Method

We adopted an interpretative, case-study approach for our examination of city technology in IBM GBS UK&I [16]. This approach is deemed appropriate for our research objective which has been to develop (rather than testing) a novel extension to smarter city technology literature. Importantly, such interpretive, qualitative research design is consistent with recent urban studies, for example by Joss and Molella [26] who used observations, interviews, and documentary research to study an eco-city in China. Our dataset comprises interviews and archival data (based on statistical databases, the media and IBM reports). This enabled findings to be triangulated to improve the validity and reliability of our results. Individual interviews formed a significant source of primary data. Multiple levels of IBM managers were selected for interview both within and outside of the specific business unit (GBS UK&I) to offer a wide perspective (refer to Table 3).

Interviewees were selected individually based on their role as follows: a) Marketing and strategy specialists from corporate headquarters: responsible for global strategy development (Level A: 2 interviews); b) UK&I strategy leaders: who take the global strategy and determine how best to implement it within the UK&I marketplace (Level B: 2 interviews); c) UK&I business leader: responsible for a specific segment of IBM's UK&I business (Level C: 2 interview); and d) the UK&I Smarter Cities implementation team: who localise the global strategy into a set of actions specific to the UK&I (Level D: 4 interviews).

Sixteen structured questions, linked with our principal research questions, formed the basis for our interview pro-forma.

Our qualitative data was analysed using content analysis, guided by the three stages described by Miles and Huberman [23]. Data reduction: the raw data was disaggregated into summary patterns. This was done in two steps: firstly as the analytic notes were written, attention was paid to the key themes; and secondly the notes were annotated, drawing out common themes, words or phrases that were important to the interviewee. Expand data display: this process uses the reduced data to organise findings and enables conclusions to be drawn. Conclusion drawing and verification: from the summarised data display. Next we present our findings.

4. Findings

This section analyses the results from our dataset in two ways: first we provide a thematic schema of IBM UK&I's Smarter Cities strategy and second we assess this schema against our conceptual framework derived from our literature review. The combination of archival analysis and interviews provided a broad base of information from which to understand the Smarter Cities strategy and its current implementation state. Triangulating data sources from interviews and analysis of strategy materials enabled common themes to emerge on the strategy definition.

4.1. IBM Smarter Cities strategy: key themes

This section provides an analysis of the IBM Smarter Cities implementation plan for the UK and Ireland. We explored the key themes of the strategy, based on our interview data. A number of

Table 5
Towards a strategic view of smart cities.

	Technology view	Systems view	Strategic view
Approach	• Smart cities comprising of particular technological infrastructure	• Smart cities as complex systems comprising of multiple sub-systems	• Smart cities as a strategic option for particular stakeholders (i.e. firms)
Principal Questions	• How do cities utilize particular technologies(for example: communication infrastructure, automation) to address societal challenges? How can this utilization be facilitated?	• How do cities develop particular sub-systems (for example, resources, infrastructure, natural environment, social systems) to deal with societal issues? How do these sub-systems interact and develop over time?	• How can city technology help organisations deal with particular strategic issues (such as downsizing)? How can particular technologies be best utilized by organisations?
Theoretical Aims	• To theorize about the ways city technologies are created and adapted over time	• To theorize about the ways cities as complex systems develop and change over time	• To theorize about the ways city technology facilitates organisational change [rethink the change bit]
Perspective	• Information systems	• Complex systems	• Organisational and strategic
Key Themes	• Smart environments • Augmented reality applications	• Adaptation • Self-organisation	• Strategic responses • Innovation • Resources
Related Papers	• [20,30,60]	• [2,21,48]	• [47]

key features of the IBM Smarter Cities approach emerged from this analysis, namely that the Smarter Cities initiative:

a) is a long-term process aiming to transform city-based technologies and, in the process, help cities achieve their strategic vision;
b) recognises that the needs and aspirations of each city may be very different;
c) requires partnerships (across many clients and with other delivery partners) to achieve the desired large-scale transformations;
d) is based heavily on dimensions from IBM's global Smarter Planet strategy, of which there are many applications in cities.

In reviewing the implementation plan, interviewees made reference to internal IBM UK&I planning documents, showing how IBM's global Smarter Cities strategy is localised within UK&I. This is an important insight, demonstrating the importance of understanding the Smarter Cities technology from the perspective of those involved in developing and implementing the strategy, in our case the IBM UK&I Smarter Cities team. This team was formed in the second half of 2009. To support the new team, materials were taken from IBM's corporate strategy team and modified for the UK&I market, considering factors such as terminology (e.g. the UK has a unique definition of a city), IBM UK&I's governance model and subject matter experts. UK&I city issues were identified (e.g. inequality, capacity, inefficiency), but not prioritised or quantified. A set of 10 city components were defined (e.g. economy, transport, public safety) and for each, diagnostics, outcomes and IBM propositions defined. A lead subject matter expert was appointed for each city component, responsible for developing the outcomes, building the community and identifying IBM's solution products. Selected city components were identified as focus areas (Transport and Buildings), for which detailed plans were developed, to identify the UK&I market opportunity, business plans for resources/skills, partner relationships, marketing, client relationships, all over a

ten year timeline, but with a five year focus. Next we examine the IBM Smarter Cities initiative against our framework.

4.2. IBM Smarter Cities strategy: evaluation against conceptual framework

In this section we examine IBM's Smarter Cities against our conceptual framework (SRAF). Our findings and related data are presented in Table 4. The following insights emerge from our analysis within each action area:

a) *Strategic focus*: the strategy is based on IBM's global Smarter Planet themes and utilizes IBM's core competencies of solving complex problems and being a technical innovator. Strategically, IBM reduces vertical integration and outsourcing or offshoring where relevant. There is no evidence to suggest that IBM is acquiring niche companies to support this strategy, an action recommended by the strategic recession action framework that would strengthen the competitive advantage of the Smarter Cities initiative;
b) *Market orientation*: in line with the SRAF recommendations, the strategy is based on high market orientation (by involving clients in many activities to understand their needs) and value pricing. Although marketing is focused on this strategy, the budget is constrained and greater focus could be placed on a more granular market segmentation;
c) *Financial*: the strategy does not involve new fixed or capital expenditure and hence follows SRAF recommendations. By seeking new clients, it aims to drive growth in market share. It also focuses on eliminating inefficiencies for clients;
d) *Operational*: this strategy re-uses existing components and solutions where possible. A greater solution-based investment could be applied to create new offerings (or modify existing ones) to enable efficient delivery;
e) *Workforce*: administration expenditure is kept at relatively low levels, in line with the SRAF recommendations. The
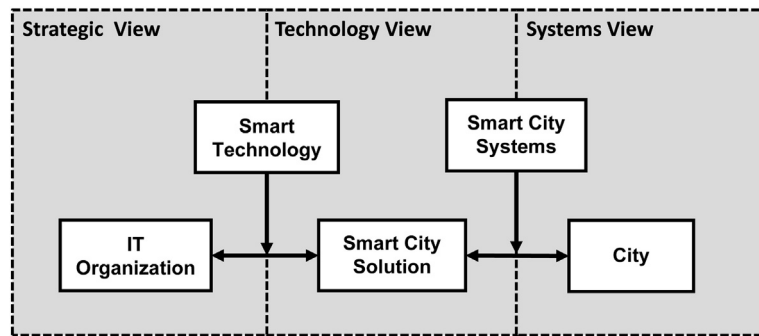
Fig. 3. Perspectives on researching a smart city solution.

SRAF recommends including a greater constructive yet aggressive risk taking within the executive team;

f) *Decision-making*: the sales team is relatively small, meaning that only a limited number of new opportunities are pursued, enabling controlled growth. The introduction of a governance model could enable progress to be reviewed more regularly. The SRAF recommends identifying measurement criteria based on clear qualification criteria.

Our analysis of the interview data against the Strategic Recession Action Framework highlighted the following positive aspects of IBM's Smarter Cities initiative (as detailed in Table 4): it is based on IBM's core values and competencies [A1]; engagements are value priced and premium-profit opportunities sought for delivering unique value to clients [A3, A20]; it is based on relatively strong market orientation: greater attention has been placed on this strategy than its predecessors [A5]; IBM UK is reducing vertical integration by outsourcing or offshoring non-core businesses [A18] and is minimising additional fixed capital, administration or capacity expenditure [A7, A10, A11]; the implementation team is seeking controlled growth by identifying a relatively low number of opportunities [A17].

Table 4 also showcases aspects of the IBM Smarter Cities strategy that could be improved: marketing budgets are focused on this strategy, yet are constrained [A4]; market segmentation should be refined to a greater level [A6]; a fall-back plan could be developed [A16]; a greater focus could be placed in removing underperformers [A14]; little has been done to developing strategic partners or acquiring companies with skills or experience to deliver the strategy [A19]; a greater attitude to risk could be taken (e.g. in growing demand or identifying opportunities) [A23].

Overall, in reviewing against the strategies for growth identified during the literature review, IBM's strategy would be classified as cautious investment [29]. Mobilising a team and identifying target opportunities are clear signs of investment (when an alternative approach during recession would be to retrench). Next we discuss these findings.

5. Conclusion: a strategic view of smart city technology during a recession

In this paper we offer a strategic view on the Smart Cities technology and examine how this view can be employed in the context of a recession. Our review of the literature on recessions showed that with a few notable exceptions [29,54], most academic sources did not consider the full breadth of strategic actions businesses could take during recession or the quantified business impact of these. Kitching et al. [29] highlight the complex nature of the business environment during a recession. Finally, little research was available to link business actions during recession with quantified post-recession growth: [54] provides the only attempt at this. Following from our review, we developed a conceptual framework of actions that businesses should take, including some that are contingent on factors such as the financial stability of the business, its marketplace position or complexity of its products. We then examined this framework through the case study of IBM UK & Ireland's Smarter Cities initiative.

Our findings from the IBM case study provide the basis for a re-evaluation of city technology from a strategic vantage point. As highlighted in Table 5, a strategic view on city technology has distinctive features compared to the more established technology and systems views. The foundational question for this view is: how can city technology be conceptualized and enacted as a strategic option?

Our study showcases the potential of Smarter Cities as a strategic option that meets corporate needs in recession conditions and can lead researchers towards a wider re-conceptualization of smart city technology, not only as a technical solution but as a strategic one. Further, we demonstrate how a Smarter Cities strategy can potentially provide ICT companies with alternative growth initiatives, particularly in a recession environment. In developing this novel, strategic approach to the smart cities concept, we have been guided by recent studies on Korean ubiquitous eco-cities (or U-cities). For instance [57] discusses the links between the U-city paradigm and e-democracy, and [5] provides insights about the U-city concept, its historical development, and, interestingly, the varieties of U-city initiatives in the West and the East. There has also been progress in our understanding of the political processes involved in building particular kinds of cities, for instance [62] used a two-year field-work to showcase the politics and inherent contradictions involved in building the Songdo city. Accordingly, future studies of smart cities could investigate the politics and contradictions, and discourse [39] that emerge internally in the organisations (or other kinds of stakeholders) involved in creating and implementing smart city technologies. Future studies could also investigate more extensively the long-term performance impact of adopting such city initiatives in ICT firms and, more generally, in

multi-business firms [41–43]. In our introduction we showed that IBM's revenue from the Smarter Planet projects has increased in recent years, yet further in-depth research in a particular sub-set of city projects would be required to evaluate the precise economic impact for IBM. Future research could also be based on performance comparisons of particular city technologies across ICT firms to help gauge the impact of particular actors, practices [4,40] and strategic tools [66] over time.

Overall, by exploring and extending the concept of smart city technology as a strategic option we contribute to extant technology and organisational literatures. This allows us to offer a more fine-tuned representation of Fig. 1 in Fig. 3. Fig. 3 showcases the three perspectives we highlight in relation to the technology and stakeholders involved in a smart city solution: the ICT organisation delivering the particular smart city solution, the focal smart city solution and the city (and its systems) that the smart city solution is developed for.

Future studies could examine a number of issues stemming from our conceptual framework. Advancing the framework further will require the incorporation of multiple case studies and usage of measurements that gauge the success of particular strategic decisions and initiatives. This would enable inductive enhancements to be made i.e. modifications to reflect the effects of observed results, until predictions from the framework match the observed results. Future studies could also explore whether the application of city technology in conditions of recession can be more or less successful, in competitiveness terms, across geographical locations [9,10], industries or business types (i.e. product and service-based businesses). Finally, further research could consider the impact of recession triggers, including the effects of shocks, crisis management and increased globalisation. These areas of future research will not be trivial to undertake, given the difficulties associated with recessions being infrequent, the time taken to complete case studies to a similar depth and making reliable measures of business performance.

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