Preventing Corporate Turnarounds through an Early Warning System

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Bankruptcy proceedings of companies have been all but new phenomena in the business world. Latest cases, encompassing Toys R Us, Fred's, and Sears in the US as well as Thomas Cook and Air Italy in Europe, demonstrate that managers often fail to run their businesses properly. As an alternative in such a case, managers could prevent potential downfalls through knowledge of a successful turnaround management. Learning about the implementation of an early warning system (EWS) might help avoid corporate turnarounds in the first place. Hence, it is crucial to offer managers a pragmatic and solution-oriented approach. That being said, the authors design a specific EWS that might contribute to bypassing corporate turnarounds at an early stage. By doing so, the article aims at disseminating information on better EWS for public corporations.

Keywords: early warning system, turnaround management, financial ratios

Introduction

Over the last years, Fred's, Toys R Us, Forever 21, Diesel USA and other retailers in the US filed for bankruptcy. One of those filing for Chapter 11 was Sears, a more than a century old US retailer. Other such examples, like Thomas Cook and Air Italy in Europe show that not only retailers but also other company types face the risk of vanishing into thin air.

In earlier times in Europe, individuals who went bankrupt, often experienced a form of humiliation. For example, in the Italian city of Padua, the law foresaw that the individuals concerned had to appear in the palace of justice, in front of a rock of shame, to publicly declare bankruptcy. Nowadays, however, bankruptcy poses a too little social stigma, according to Sullivan et al. (2006). Therefore, it is not surprising that failures in corporations have been documented widely in the literature, as shown by Hofer (1980), Coleman (2004), and Lymbersky (2011), and concern not only private but also public organisations, as pointed out by Boyne (2004, 2006), and Cornforth and Paton (2004).

No company is entirely immune against economic distress and there seemingly is an aura of inevitability concerning eventual organisational failure. In many cases, as Slatter and Lovett (1999), Collard (2002), Faulhaber and Grabow (2009), Müller (2013), and Pepels (2015b) indicate, this stems from ignoring the signs of looming crises. In this context, early warning signals are frequently misinterpreted or hushed because of the unwillingness of the management to admit that their strategy is failing. Far too often it is only intervened when the liquidity and the continued existence of the company is already threatened, as displayed by Slatter and Lovett (1999).

Knowledge can be considered as a competitive advantage (Grant, 1997), as well as a substantial resource of companies (Polanyi, 1966). And yet its impact on innovation to tackle entrepreneurial challenges cannot be overestimated (Nonaka, 1994; Seidler-de Alwis and Hartmann, 2008). However, creating new knowledge constitutes a dynamic interplay between individuals and organisations, encompassing a high degree of context, such as specific time and space (Nonaka et al., 2000), that might lead to a journey 'from being to becoming' (Prigogine, 1980).

As history shows, management often underestimates the strategic change in the wake of business turnarounds. Trying to avoid learning the wrong lessons from history, the authors seek to reveal key factors that can lead to firms escaping from a potential failure (Wild, 2010). To protect the management from corporate failures better, the work presents a system, which might prevent corporate turnarounds in the first place. Hence, the authors test the most prominently discussed crisis recognition tools on several case studies to create an early warning system (EWS), enabling companies to detect potential symptoms at an early stage.

Literature Review

While there has been a large body of research in view of corporate turnarounds, such as from Schendel et al. (1976), Schendel and Patton (1976), Bibeault (1998), Vinten et al. (2005), the subject of early crisis recognition, despite its practical significance, has not been a major focus of researchers in the past. The focus was put more on establishing a general approach and techniques for turnarounds, as noted by Slatter and Lovett (1999), and Platt (1998), or addressing the topic from a more specific standpoint. Slatter et al. (2006) concentrated on leadership during turnarounds, whereas Driendl (2012) looked at turnarounds form a stock market perspective and set out how profitable some turnaround stocks might become. Others dealt with identification of distinct turnaround strategies, as, for example, for small firms by Boyle and Desai (1991), restaurants, as displayed by Chathoth et al. (2006), hospitals, shown by
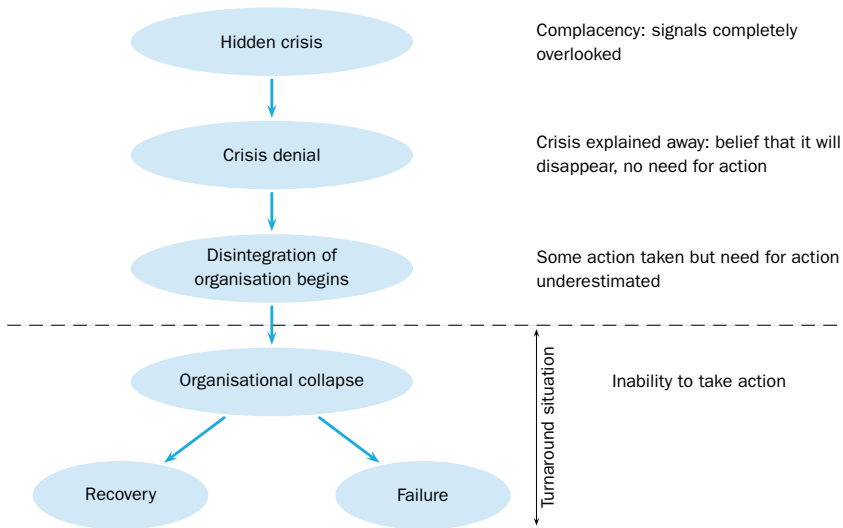
Figure 1   Four Stages of Crisis Development, according to Slatter and Lovett (1999)

Langabeer (2008), or industrial business units, as pointed out through Hambrick and Schecter (1983).

Organisational crises usually develop according to the four-stage model by Slatter and Lovett (1999), as shown in Figure 1. According to it, the internal recognition that a company is in trouble usually comes as a surprise, despite the crisis being triggered long before. Schendel et al. (1976) define a turnaround situation as a low-probability and longer lasting, high-impact situation leading to a decline in performance. However, challenges faced are often ill defined and lack a single solution path, as note by Mumford et al. (2000).

In general, a turnaround situation occurs as soon as corporate survival is doubtful. Once such a state is apparent, corrective measures must be taken to salvage the company from bankruptcy, as Slatter and Lovett (1999) point out. As soon as an organisation regresses into a turnaround situation, long-term strategic planning recedes into the background, and ad-hoc management measures are employed to try to turn the situation around. Therefore, turnarounds pose stressful situations for a corporation, as Finkin (1987), Faulhaber and Grabow (2009), and Marti (2013) show, owing to ad-hoc corrective measures, which usually divert personnel from routine tasks. Additionally, highlighted by Lenahan (1999), the use of external resources often escalates the already considerable costs of the event and many companies fail to execute a successful turnaround and go bankrupt.

Turnaround management includes all activities undertaken by an organi-
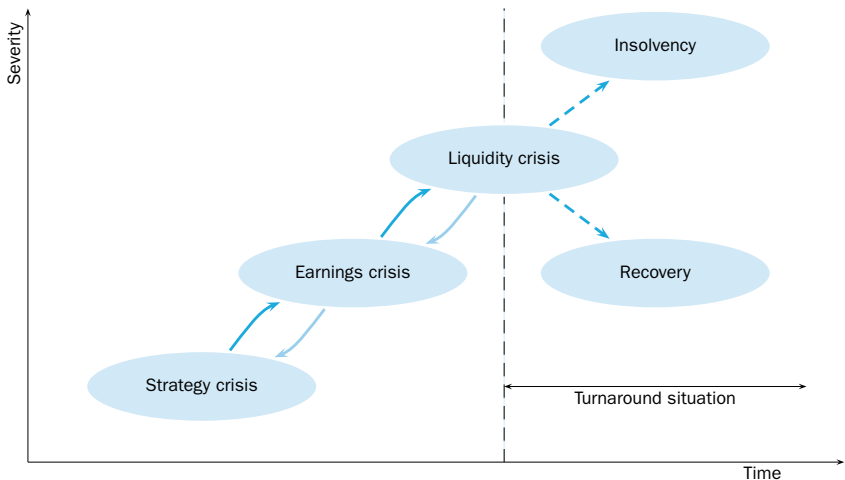
Figure 2 Emergence and Recognition of Organisational Crises, as shown by Bichkoff and Eilenberger (2004), Evertz and Krystek (2014), and Müller (2013)

sation in an existence-threatening state, to avert impending insolvency and return to sustainable profitability, as Buschmann (2006), Driendl (2012), and Pepels (2015a) note.

Building on this model, research generally distinguishes between three types of organisational crises of increasing severity, as illustrated in Figure 2. A strategy crisis is less serious than an earnings or liquidity crisis and thus accompanied by less obvious signs. The longer a crisis remains un-controlled, the more severe it gets and the more obvious the warning signs become. Far too often, crises are not acknowledged until the liquidity of the company is endangered (Müller, 2013). This is highlighted by the arrows in Figure 2, as light arrows shows the order of recognition and dark arrows the order of emergence.

Since the crisis types continuously progress over time, the importance of early recognition can be highlighted. Furthermore, it challenges the no-tion indicated by Platt (1998) and Pepels (2015a), where long-term strategic planning is not considered the highest priority during a corporate turnaround and the concerns about the future and longevity of the company are re-placed by the immediate objective of saving the company from insolvency. Such a focus reinforces the application of methods such as cost-cutting, asset reduction or downsizing is, which often only lead to short-lived stabil-isation of the business, as Slatter et al. (2006) shows.

Consequently, researchers have recognised the pitfalls to this being the sole measure of turnaround success and directed the attention to-wards the sustainability of such endeavours, like authors, such as Barker

and Duhaime (1997), Bickhoff and Eilenberger (2004), and Faulhaber and Grabow (2009), suggest.

Given the availability and relevance in business failure prediction, *financial ratios* are frequently used as crisis indicators, as Platt (1998), Situm (2013), and Zopounidis and Doumpos (1999) note. Further, *discriminant analyses* (Altman, 1968) and *logistic regressions* (Situm, 2013) both also building on multiple financial ratios, have commonly been used to evaluate financial health. The main caveat of the application of ratio-based analyses is that financial statements could be subject to creative accounting, and thus may provide a distorted picture of the company accounts and the severity of the crisis. The risk can partly be mitigated by relying on data from annually prepared statements, as they are audited and provide a more truthful view (Plattt, 1998). Additionally, there is a high possibility that there is a time lag between the internal occurrence and external recognition of the crisis as most audited financial reports are published annually (Slatter & Lovett, 1999).

Methodology

The broad EWS created for the analysis of the case studies consists of specific ratio analyses, Altman's (1968) discriminate model and Doumpos and Zopounidis' (1999) logistic regression. Appendix shows the formulas of how the different EWS scores are calculated. The framework is applied to several case studies and is tested on its predictive abilities. The cases have been selected based on the presence of a crisis, the availability of financial information, as well as the inclusion of various industries. The investigated timespan has also been subject to the availability of financial information. The analysis will consist of a thorough evaluation of the specific companies' financial performance over various fiscal periods. The results are displayed in a radar chart, where the changes in each measurement can be traced and interpreted.

The figures are interpreted based on the changes in each measurement and the predictive ability of different measurements is assessed. In doing so, the final framework can be condensed to the few most decisive measurements. The ratios used in subsequent analysis have been selected based on their ability to predict crisis situations and their prominent use in past research. The selected ratios were, with the exception of the quick ratio and ROE, used by more than one third of the sources analysed. The ROE has been specifically taken into consideration because of its ability to illustrate the impact of debt on the generated return when compared with the ROA (Leach, 2010). The quick ratio has been added to the analysis due to its capability to quantify the impact of accumulation of inventory on a firm's ability to cover all its short-term liabilities (Leach, 2010).

Table 1   Scale Determinants

	(1)		(2)		Debt ratio	
	Lowest	Highest	Lowest	Highest	Lowest	Highest
BlackBerry	0.447	5.027	–0.186	1.166	0.111	0.520
Bristol-Myers Squibb	2.460	14.188	0.059	0.550	0.478	0.665
General Electric	0.487	2.041	–0.001	0.058	0.774	0.835
Rolls-Royce	3.401	12.903	0.054	0.110	0.663	1.033
	Current ratio		Quick ratio		ROA	
	Lowest	Highest	Lowest	Highest	Lowest	Highest
BlackBerry	2.059	6.489	1.779	6.284	–77.8%	26.5%
Bristol-Myers Squibb	1.150	2.210	0.947	1.987	–5.4%	34.2%
General Electric	1.625	3.570	1.410	3.417	–7.3%	2.4%
Rolls-Royce	1.202	1.485	0.793	1.160	–15.8%	14.4%
	ROE		Z-score		Logit model	
	Lowest	Highest	Lowest	Highest	Lowest	Highest
BlackBerry	–162.0%	32.9%	–0.557	25.454	0.0%	100.0%
Bristol-Myers Squibb	14.4%	71.5%	3.152	9.469	90.3%	100.0%
General Electric	–4.4%	12.2%	1.054	1.879	0.1%	15.9%
Rolls-Royce	–228.0%	68.2%	0.212	1.850	0.0%	99.9%

Notes   (1) working capital turnover, (2) cash flow to debt ratio.

This work uses Altman's (1968) multiple discriminant analysis to predict corporate turnaround situations. Due to the model discriminating between bankrupt (score below 1.81) and non-bankrupt firms (score above 2.67), negative changes in the Z value reflect underlying problems within the organisation and thus warn of imminent crisis situations. Negative changes in the score can be seen as an early indicator for a potential crisis, even if the score lies far above the grey area.

The logit model is also based on financial ratios, but, unlike Altman's (1968) Z-score, its foundation is a logistic regression and includes different parameters, according to Situm (2013). Research shows that it is one of the main alternatives to Altman's (1968) discriminant analysis and overcomes some of its limitations, as demonstrated by Doumpos and Zopounidis (1999), and Situm (2013). According to the latter, the most prominent advantage is that it indicates a company's probability of financial health. In brief, when a company achieves a score of 82 per cent, it shows an 82 percept probability to be in a healthy financial situation. Were the score to drop below 78 per cent, a firm is considered financially stricken (Situm, 2013).

Since all employed tools yield a different result that can only be interpreted on its specific scale, all figures need to be converted to a single scale in order to be compared to one another. Therefore, this work first determined the acceptable ranges for each ratio and converted those to

a single 0 to 10 scale, where 0 is the lowest (worst) and 10 the highest (best) score. The acceptable ranges are based on the highest and lowest scores in the respective ratio across all case studies, which are adjusted if the scores are deemed outliers, see Scale Determinants in Table 1.

In cases where the score exceeds the set range, they are fixed on either lowest or highest range score respectively in order to facilitate interpretation of the results. To convert the figures to the radar scale, a conversion function for each specific measurement was established, as displayed below. The variable x_1 stands for the initial ratio result, whereas x_2 shows the results on the radar scale. If the working capital turnover, for example, was 4.0 for any case study, the score shown on the ratio scale would be 5.8, as given by its specific scale conversion function.

Formulas for Conversion to Radar Scale

Working capital turnover $\quad x_2 = \dfrac{x_1 + 25}{5}$

Cash flow to debt ratio $\quad x_2 = \dfrac{x_1 + 0.5}{0.2}$

Debt ratio $\quad x_2 = \dfrac{x_1 - 1.5}{-0.15}$

Current ratio $\quad x_2 = 2x_1$

Quick ratio $\quad x_2 = 2x_1$

ROA $\quad x_2 = \dfrac{x_1 + 20}{6}$

ROE $\quad x_2 = \dfrac{x_1 + 20}{6}$

Z-score $\quad x_2 = x_1$

Logit model $\quad x_2 = \dfrac{x_1}{10 \times 100}$

Analysis

The findings of the analysis are presented in a coherent manner. The results of the EWS model applications to what is deemed the relevant timespan for early crisis recognition are illustrated, and the development of each measurement score is assessed. To increase the understanding, the calculated scores and their radar score equivalent have been given in squared brackets [ratio value/radar score]. By applying the framework from the literature review to case studies, the applicability of the different parameters in terms of early crisis recognition is evaluated.
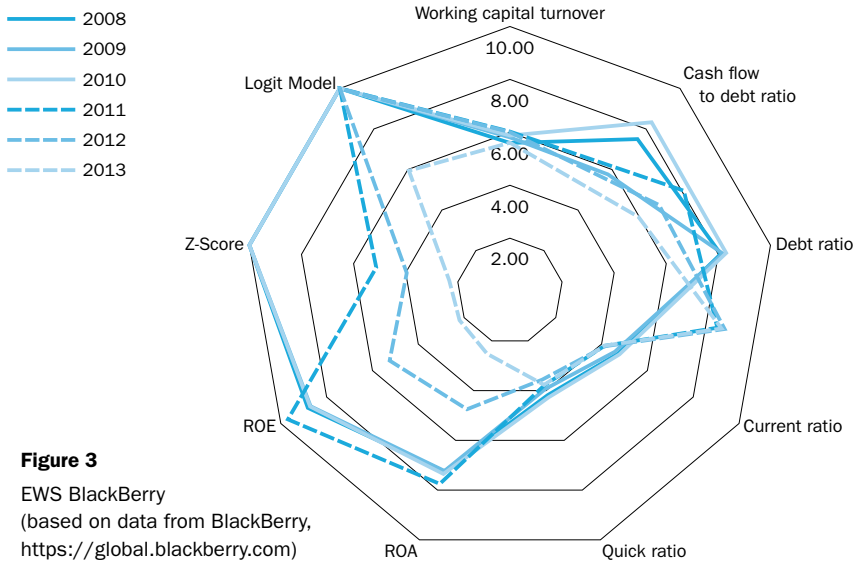
Figure 3

EWS BlackBerry
(based on data from BlackBerry,
https://global.blackberry.com)

BlackBerry

Activity. The organisational efficiency, as measured by the working capital turnover, continuously increased from 2008 [3.00/5.60] to 2011 [5.16/6.03]. In the following year, there was a marginal decrease in the ratio [5.03/6.02], followed by substantial decrease in 2013 [3.03/5.61]. The working capital turnover has been decreasing ever since, falling below 1 in 2018.

Coverage. The cash flow to debt ratio shows the first considerable decline between 2008 [1.00/7.50] and 2009 [0.65/5.76]. In the following period, the ratio nearly doubled [1.17/8.33], before beginning to decrease again in 2011 [1.02/7.59]. In the 2012 fiscal year [0.80/6.51], a further decline in the coverage ratio can be recognised. The negative trend continued, and the ratio dropped by nearly 40 percept until 2013 [0.62/5.61]. In 2014, the operating cash flow coverage became negative.

Leverage. The debt ratio changed only marginally over the assessed period from 2008 [0.29/8.09] to 2013 [0.28/8.12]. The debt ratio initially decreased until 2010 [0.25/8.30], showing an increasingly less risky financial situation for BlackBerry. Beside a small spark in the ratio in 2011 [0.31/7.96], marking the highest level of debt for the recognition-relevant time period, the debt level increased rather drastically thereafter.

Liquidity. The quick and current ratios improved from 2008 [Current: 2.36/4.72; Quick: 2.08/4.18] until 2010 [Current: 2.39/4.78; Quick: 2.13/4.27] and began to drop in 2011 [Current: 2.06/4.13; Quick: 1.89/3.79]. Both ratios remained roughly on the same level for the rest of the times-

pan. Overall, the liquidity ratios stayed above their respective limits, which implies financial health for the whole recognition-relevant period.

Profitability. In the beginning, the ratios slightly declined from 2008 [ROA: 23.5/7.25; ROE: 32.9/8.70] to 2009 [ROA: 23.4/7.23; ROE: 32.2/8.70]. From there on, the ratios improved until 2011 [ROA: 26.5/7.75; ROE: 38.2/9.69], before plummeting by nearly 75 per cent in 2012 [ROA: 8.48/4.75; ROE: 11.5/5.25] and becoming negative in 2013 [ROA: – 4.91/2.52; ROE: –6.83/2.20]. BlackBerry continued to generate negative profits until the 2018 fiscal period.

Discriminant and Logit Analysis. The logit score remained above 99 per cent until 2013 [59.4%/5.94], where it fell notably, indicating the presence of a turnaround situation. The score fell further to 0 percept in the following fiscal year, which indicates a 100 percept probability that BlackBerry was in financial troubles. In 2010 [12.0/10], the Z-score was still above the upper limit of the radar scale, but decreased by more than 50 per cent in 2011 [5.13/5.13]. This worrying development continued, and the Z-value fell further until 2013 [2.33/2.33] and even became negative in 2014.
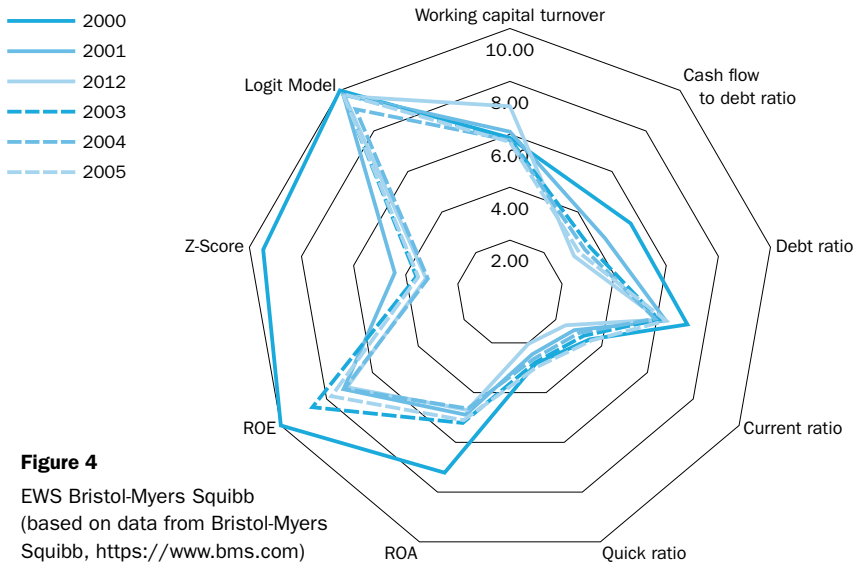
Bristol-Myers Squibb

Activity. The working capital turnover of Bristol-Myers Squibb has improved drastically between 2000 [4.35/5.87] and 2002 [10.3/7.06], and the ratio more than doubled. In the subsequent year [4.11/5.82], the ratio plummeted lower than the 2000 level and further decreased until 2005 [3.56/5.71]. Consequently, while the capital was managed increasingly more efficiently until 2002, the notable drop in efficiency in 2003 indicates serious underlying issues within the organisation.

Coverage. The cash flow to debt ratio decreased remarkably in the first two years, from [0.55/5.27] in 2000 to [0.06/2.80] in 2002. This shows that by 2002, at the lowest point of the year-end stock price development, Bristol-Myers Squibb could only cover six per cent of its debt with its operating cash flow. The ratio then improved remarkably in 2003 [0.20/3.49], before declining in 2004 [0.16/3.28] and 2005 [0.11/3.04].

Leverage. The debt ratio in the Bristol-Myers Squibb example shows a substantial increase in the first five fiscal periods from [0.48/6.81] in 2000 to [0.66/5.57] in 2004. This indicates that an increasingly higher proportion of the invested funds was raised from liabilities. In 2005 [0.60/5.99], the ratio began to decrease again.

Liquidity. Since both liquidity ratios remained above 1 for the entire period, they do not indicate grave liquidity issues. Both ratios decreased in the first three years, from 2000 [Current: 1.74/3.49; Quick: 1.42/2.84] to 2002 [Current: 1.21/2.43; Quick: 1.02/2.04]. Subsequently, the current and quick ratio both increased until 2005 [Current: 1.78/3.57; Quick:

Figure 4

EWS Bristol-Myers Squibb
(based on data from Bristol-Myers
Squibb, https://www.bms.com)

1.48/2.97], with shortly decreasing in 2004 [Current: 1.50/3.01; Quick: 1.32/2.64].

Profitability. Overall, the pharmaceutical industry is extremely profitable, which is shown by Bristol-Myers Squibb achieving a ROA of up to 34 per cent and a ROE of over 70 per cent in 2009. During the assessed period, profitability initially decreased drastically between 2000 [ROA: 23.3/7.22; ROE: 44.6/10] and 2001 [ROA: 9.34/4.89; ROE: 23.4/7.26]. In the following two periods, Bristol-Myer Squibb achieved an increase in profitability until 2003 [ROA: 11.3/5.22; ROE: 31.7/8.62], before it dropped in 2004 [ROA: 7.85/4.64; ROE: 23.4/7.23] and rose again to similar heights in 2005 [ROA: 10.7/5.11; ROE: 26.8/7.79]. Overall, there is a distinct negative development over the recognition timespan, which serves as an indicator for the struggles Bristol-Myers Squibb faced during this period.

Discriminant and Logit Analysis. The Z-score shows the same pattern as the profitability ratios, as it decreased drastically from 2000 [9.47/9.47] to 2001 [4.42/4.42] and further declined in 2002 [3.22/3.22]. Thereafter, the score improved until 2005 [3.52/3.52], which shows that a potential crisis was tackled accordingly. The logit score never indicated the presence of a turnaround situation, as the lowest point in 2004 [90.7%/9.07] remained far above the 78 per cent limit. Hence, the company never faced liquidity troubles during the organisational decay.

General Electric

Activity. The working capital turnover increased in the analysed timespan from 2014 [0.50/5.10] to 2018 [2.04/5.41]. The remarkable increase

Figure 5

EWS General Electric
(based on data from General
Electric, https://www.ge.com)
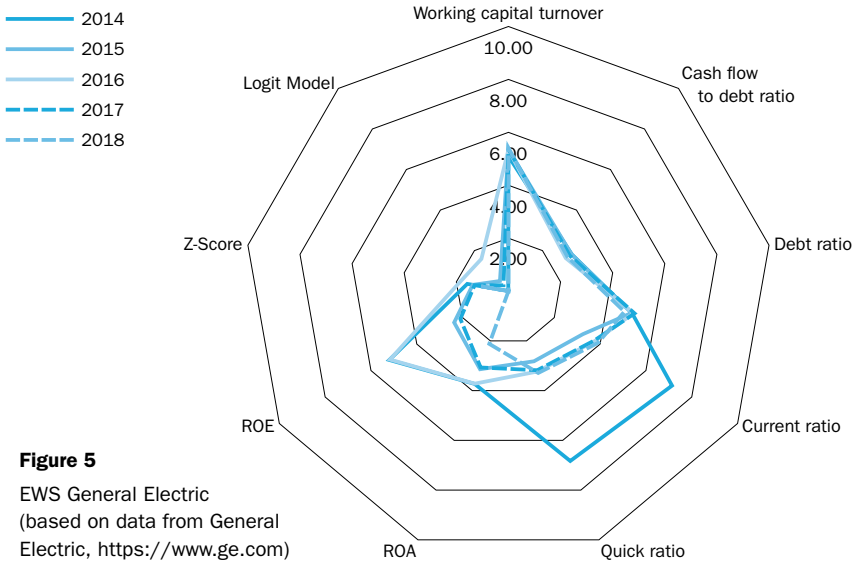
shows that the working capital is progressively employed more efficiently, despite the company suffering from a major stock price decline. The drastic increase from 2014 [0.50/5.10] to 2015 [1.79/5.35] may have increased management optimism regarding the future prospects of the firm, since it correlated with the initial stock price improvement.

Coverage. The cash flow coverage was already extremely poor in 2014 [0.05/2.77], remained on the same level in 2015 [0.05/2.76], before it became negative in 2016 [–0.0009/2.50]. In the following fiscal period in 2017 [0.04/2.68], it improved to around 4 per cent, only to plummet again in 2018 [0.02/2.58]. Overall, at no point during the examined timespan was the operating cash flow covering more than five per cent of the total liabilities of General Electric.

Leverage. There was small net increase in the debt ratio from 2014 [0.79/4.74] to 2018 [0.83/4.45], which shows that the financial situation of General Electric became riskier in the course of the corporate decay. However, this is only reflected in a marginal increase and the ratio remained roughly on the same level throughout the assessed period.

Liquidity. Both ratios decreased remarkably by more than 50 per cent between 2014 [Current: 3.57/7.14; Quick: 3.42/6.83] and 2015 [Current: 1.63/3.25; Quick: 1.41/2.82]. In the following years, both ratios gradually increased again until the most recent fiscal year [Current: 1.96/3.91; Quick: 1.65/3.29], without ever approaching similar values as in 2014.

Profitability. While the profitability initially increased until 2014 [ROA: 2.37/3.73; ROE 11.2/5.20], it plummeted to negative figures in 2015 [ROA: –1.18/3.14; ROE: –5.79/2.37]. However, the fact that the profitabil-

ity recovered in 2016 [ROA: 2.34/3.72; ROE: 11.0/5.17] may have fostered the internal belief that the fall in corporate performance was only an evanescent issue. By again achieving negative profits in 2017 [ROA: –1.6/3.07; ROE: –7.39/2.10] and further declining profitability in 2018 [ROA: –7.26/2.12; ROE: –43.6/0], the corporate crisis was likely to have been acknowledged.

Discriminant and Logit Analysis. While the net profits were still increasing between 2010 and 2014, the logit score was declining and showed a 0.07 per cent probability that General Electric was financially sound in 2014 [0.07%/0.01]. Although the score improved until 2016 [15.9%/1.59], the financial situation only improved marginally with the logit score still indicating imminent bankruptcy.

Furthermore, also the Z-score already showed the underlying troubles within General Electric in 2014 [1.58/1.58]. The score continuously decreased, with the exception of a spike 2016 [1.88/1.88], and reached its lowest point in 2018 [1.05/1.05].
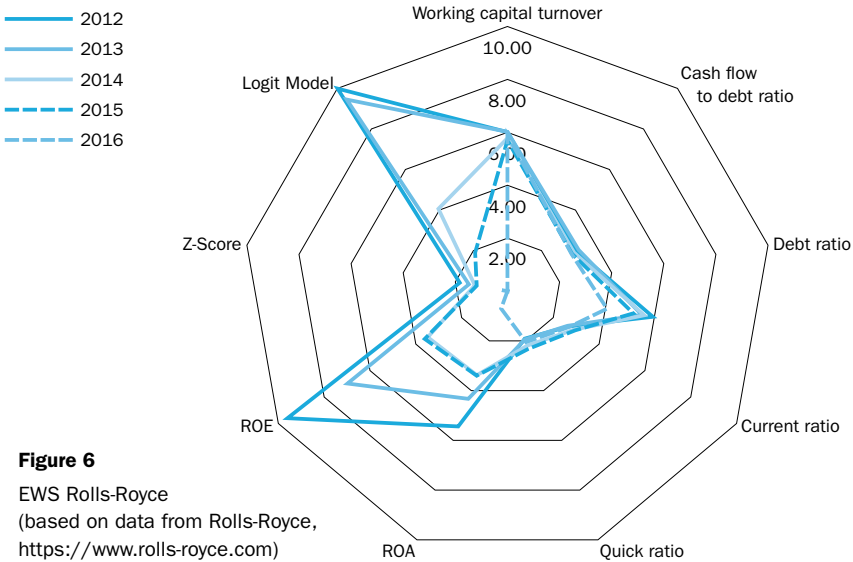
Rolls-Royce

Activity. While the working capital turnover marginally improved between 2012 [5.07/6.01] and 2013 [5.11/6.01], it plunged in 2014 [3.92/5.78] and further decreased in 2015 [3.48/5.70]. In the following fiscal period [4.50/5.90], the working capital was employed more efficiently again. The increase in the WC turnover possibly indicates that the previously existing problems have been overcome.

Coverage. The cash flow to debt ratio showed and initial increase from [0.10/3.02] in 2012 to [0.12/3.11] in 2013, before falling to [0.08/2.91] in 2014. In the following two fiscal years, the coverage ratio further declined until reaching [0.06/2.80] in 2016. Consequently, it can be recognised that the cash flow coverage of the total liabilities progressively decreased over the analysed timespan.

Leverage. The debt ratio continuously increased from [0.66/5.58] in 2012 to [0.71/5.25] in 2014, to [0.93/3.82] in 2016. This progressive incline in the debt ratio implies that financial situation of Rolls-Royce has become increasingly riskier over the course of the analysis, as the proportion of assets financed by debt increased remarkably.

Liquidity. The liquidity ratios increased in the first four years from 2012 [Current: 1.33/2.67; Quick: 0.95/1.91] to 2015 [Current: 1.48/2.96; Quick: 1.16/2.96], which implies that Rolls-Royce's ability to cover its current liabilities increased during this period. In 2016 [Current: 1.35/2.70; Quick: 1.02/2.70], both ratios decreased and have been declining ever since.

Profitability. 2012 [ROA: 12.7/5.44; ROE: 37.6/9.60] was an outlier

Figure 6

EWS Rolls-Royce
(based on data from Rolls-Royce,
https://www.rolls-royce.com)

year regarding Rolls-Royce's profitability as it skyrocketed. Subsequently, the ratios decreased by more than 50 per cent in 2013 [ROA: 5.80/4.33; ROE: 21.9/6.98] and further plummeted in 2014 [ROA: 0.21/3.38; ROE: 0.91/3.48]. A slight increase in 2015 [ROA: 0.38/3.40; ROE: 1.67/3.61] was answered by negative profitability ratios in 2016 [ROA: –15.8/0.70; ROE: –216/0].

In the following years, the ratios fluctuated immensely between high returns in one period and negative returns in another. The annual statement shows that the outlier year in 2012 could have been due to restructuring a business unit, as noted by Rolls-Royce (2013).

Discriminant and Logit Analysis. The corporate decay was signalled by a steadily declining Z-score from [1.83/1.83] in 2012 to [0.21/0.21] in 2016. The immense initial drop from 2012 [1.83/1.83] to 2013 [1.48/1.48] classified the company as insolvent, according to Altman's (1968) definition. By nearly reaching 0, the discriminant analysis indicates that Rolls-Royce was extremely close to organisational failure. The logit score shows a similar reality as in other case studies. Subsequently to the Z-score declining in 2013, the logit model indicated a 40.6 per cent chance of financial health in 2014 [40.6%/4.06].

In the previous two years, the ratio only declined marginally from 2012 [99.9%/9.99] to 2013 [94.5%/9.45]. After already indicating financial troubles in 2014, the logit score further declined to 0 per cent in 2016 [0.00%/0].

Results

BlackBerry

In the BlackBerry case, the crisis transitioned to an earnings crisis in 2012, as the net income began to be affected. In the following year, the logit score indicated a shift towards liquidity crisis. According to the theory, it can be assumed that the crisis was recognised as soon as the first losses occurred in 2013.

Although the falling stock price may have already raised awareness of a potential crisis in 2011, the consequent period of continuous growth hints at optimism potentially still being the prevailing management rhetoric at the time. The EWS framework clearly indicated the deteriorating situation two years before the solvency of the firm became endangered, as the declining Z-score in 2011 should have already caused serious concern among BlackBerry's top management. In the following year, the falling profitability, combined with the decreasing coverage ratio, further underlined the increasing severity of the symptoms.

Bristol-Myers Squibb

The company's net income hardly declined over the period. Plus, the liquidity was never endangered either. It appears that the crisis was recognised in due time, since the strategy crisis never transitioned to the next crisis stage. The application of the system reveals that the first concerning signs became visible in 2001, when the Z-score decreased substantially. Therefore, the framework hints at an imminent turnaround situation one year before the crisis was arguably recognised due to the fall in the year-end stock price.

However, it can be assumed that corrective measures were taken accordingly, stopping the organisational decay as the earnings or liquidity situation of Bristol-Myers Squibb never was affected. Moreover, the fact that most of the scores improved in 2005 possibly indicates that the measures have been successful. Without such action, the logit score would have arguably decreased further in the following years, potentially indicating a turnaround situation. As a result, this case serves as an example of how the early recognition of a looming crisis can lead to a timely resolution.

General Electric

GE's discriminant value only slightly surpassed the proposed lower limit of 1.81 in its outlier year in 2016. This short-lived improvement coincided with the highest stock price for the complete timespan. The General Electric case is somewhat an exception to the previously analysed cases, as the logit score and Z-value have indicated a crisis situation since the beginning

of the timeframe. Although the stock price was still achieving continuous growth, the underlying issues within the corporation became increasingly more visible.

A notable decrease in the liquidity, as well as the profitability ratios in 2015, further reinforced the existence of a corporate crisis even before the stock price plummeted. While the company generated net losses in 2015, fiscal results were probably seen as negative outliers, due to the subsequent increase in net revenues in 2016. This development is also recognised on the stock market and reflected in an additional increase in the stock price. Consequently, it can be argued that the existence of the crisis was not acknowledged until 2018, when the net losses increased more than threefold. Since the logit score was consistently indicating a turnaround situation, liquidity crisis was apparent, and the application of the model would not have predicted the crisis prior to affecting the solvency of the firm. However, since it can be argued that the crisis was not acknowledged until 2018, the EWS would have enabled the GE management to introduce corrective measures at least four fiscal periods prior to the crisis recognition.

Rolls-Royce

In this case, the declining discriminant and logit results show that the imminent crisis became increasingly severe and reached the liquidity crisis stage in 2014. The decline in the logit score indicated this transition to the next crisis stage already in the previous year. Furthermore, it could even be argued, since the Z-score was never above 1.85 in any of the previous period, that the symptoms of the looming crisis were already visible six fiscal periods before the logit score indicated that Rolls-Royce's solvency was endangered. Consequently, the application of this model once again managed to show the underlying organisational issues, while the stock market was still largely optimistic.

Conclusion

To conclude, the application of the EWS yielded clear results regarding the predictability of crisis situations. That said, based on the cases, the EWS was able to predict looming organisational crises on average 3.25 years prior to their occurrence. In many cases, crisis symptoms were already visible two or more years prior to either the liquidity being affected, or the crisis situation being recognised.

In the Rolls-Royce example, the signs should already have caused serious concerns six years prior to the crisis, whereas the General Electric case showed that the crisis could have been recognised four years earlier. In both cases the rising stock price indicated that the overall perception of

the company was still positive during a period where red flags were already visible.

The Bristol-Myers Squibb case reinforced the notion that crises are more easily rectified if they are recognised earlier. In general, the case studies have clearly shown that turnaround situations, as implied by a fall in the logit score, are predictable. In nearly all of the cases, the symptoms were evident before a turnaround situation was apparent. The first indicators of the looming decay are often a decline in the Z-value, followed by negative changes in the organisational profitability. The cash flow to debt ratio was in some cases more, and in others less meaningful.

Overall, neither the activity, leverage nor liquidity ratios were able to unambiguously indicate a negative trend development. Therefore, the proposed conceptual framework can be condensed to the most indicative factors, namely the Z-score, coverage and profitability ratios that signalled the looming crisis reliably. The logit score is further included in the final EWS because of its importance in defining the existence of a turnaround situation. In condensing the framework, its application and interpretation can be facilitated.

The aforementioned explanations provide strong evidence that all turnarounds are preventable, as long as they are predictable. For this to happen, an EWS is essential to guarantee both more time and alternatives to respond to the crisis. By applying an internal EWS, managers are enabled to identify challenges at an early stage. Thereby, the EWS allows the management to initiate counteractions to prevent the company from a potential bankruptcy filing. This might be, amongst a row of potential other measures, the launch of an internal investigation in view of the underlying issues causing the adverse effect on the company business.

Overall, it can be concluded that the created EWS is a step forward regarding crisis recognition and can possibly serve as the foundation for a more extensive framework in the future. Future studies should consider the application of the model in a practical environment to confirm the framework value in real-life situations. Further, they could take industry-specific aspects into consideration to enhance the quality of each scale provided. Following this, the illustration of the radar scales as well as its interpretation could be optimised. Finally, future works on this topic should concentrate on the integration of qualitative factors in the EWS framework. This, in turn, might help to recognise a looming threat to the organisation even earlier and potentially facilitate a stronger in-depth analysis regarding the reasons for deterioration.

The nature of the analysis applied is subject to the validity of publicly available financial statements. Since the annual reports only show the specific performance at the end of the fiscal years, the predictive abilities of

the framework may be restricted. Furthermore, it highlights one of the EWS weaknesses, which, as the case studies have revealed, points to the quick deterioration of specific situation of the company taking place from one year to another. The foregoing stands in opposition to the assumption of a rather slow and gradual decline.

However, for company internal applications of the EWS, this becomes less relevant as the monitoring of the scores can be performed on a more regular basis. Therefore, internal use would potentially allow for an even earlier crisis recognition, as the decline may appear less drastic if the scores are evaluated biannually or quarterly.

Additionally, the framework does not indicate why the analysed scores are changing or how the crisis could be overcome, due to the lack of qualitative parameters. It only indicates that there are organisational problems apparent, but is subject to further analysis of financial statements, macroeconomic- and company-specific factors in order to define the root causes of the organisational decay. The framework does not account for the prediction of crises due to unforeseeable events or fraudulent behaviour, as this arguably should be part of a company risk management rather than crisis prediction.

Lastly, all cases have been analysed retrospectively, which arguably makes it easier to determine negative trends. Consequently, it could be argued that while the developments seem obvious in past cases, the application of the framework in real time would not yield similar results. Therefore, the capabilities of the EWS, when applied in practice, still need to be verified, but based on the clear results, a successful transition to corporate application could be expected.

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Appendix 1: Formula Directory

Financial Ratios

Activity Ratio $Working\ capital\ turnover = \dfrac{Sales\ revenue}{Net\ working\ capital}$

Coverage Ratio $Cash\ flow\ to\ debt\ ratio = \dfrac{Operating\ cash\ flow}{Total\ debt}$

Leverage Ratio $Debt\ ratio = \dfrac{Total\ debt}{Total\ assets}$

Liquidity Ratio $Current\ ratio = \dfrac{Current\ assets}{Current\ liabilities}$

Liquidity Ratio $Quick\ ratio = \dfrac{Cash + market.\ sec. + receivables}{Current\ liabilities}$

Profitability Ratio $ROA = \dfrac{Net\ income}{Total\ assets}$

Profitability Ratio $ROE = \dfrac{Net\ income}{Shareholder's\ equity}$

Discriminant Analysis

$$Z = (1.2x_1) + (1.4x_2) + (3.3x_3) + (0.66x_4) + (1.0x_5)$$

$$x_1 = \frac{Working\ capital}{Total\ assets} \quad x_2 = \frac{Retained\ earnings}{Total\ assets} \quad x_3 = \frac{EBIT}{Total\ assets}$$

$$x_4 = \frac{Market\ value\ of\ equity}{Book\ value\ of\ debt} \quad x_5 = \frac{Sales}{Total\ assets}$$

Logit Model

$$F = \frac{1}{1 + e^{-(13.7813 - 4.7252x_1 + 52.9741x_2 - 3.0594x_3 - 14.558x_4 + 0.1886x_5)}}$$

$$x_1 = \frac{Gross\ profit}{Total\ assets} \quad x_2 = \frac{Net\ income}{Total\ assets} \quad x_3 = \frac{Quick\ assets}{Current\ liabilities}$$

$$x_4 = \frac{Total\ debt}{Total\ assets} \quad x_5 = \frac{Net\ worth}{Net\ fixed\ assets}$$

Other Formulas

$Working\ capital = Current\ assets - Current\ liabilities$

$Total\ market\ value = Year\ end\ stock\ price \times Shares\ outstanding$

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