SWOT ANALYSIS USING GENERAL MORPHOLOGICAL ANALYSIS

Application to the Specials Sector for new Business Drivers

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The humble SWOT (Strengths, Weaknesses, Opportunities and Threats) is a remarkably simple problem structuring framework. Ubiquitously taught in business schools, it is often the first port of call in many organisations to map out tactical approaches for short to near term projects. Since its introduction by Albert Humphrey[1] in the 60s, however, it has surprisingly undergone little revision – the lack of facilitation of constructing a SWOT in the business setting, particularly the haphazard way of inter-relating the various elements within each quadrant, has failed to realise the technique's true potential.

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In their seminal paper, Hill and Westbrook[2] from London Business School cited that seasoned strategy professionals displayed similar deficiencies when performing a SWOT analysis — "long lists (over 40 factors on average), general (often meaningless) descriptions, a failure to prioritize and no attempt to verify any points." Most worrying was the universal finding that no-one subsequently used the outputs in the later stages of the strategy formulation. The more pertinent question remained: what, if any, was the output?

In this paper, we report a major improvement of how a SWOT should be constructed and analysed by using the process of Cross Consistency Assessment (CCA), transforming it into an actionable framework. Here, each and every suggestion from each quadrant is compared pairwise to test for compatibility. The CCA is similar to a cross impact analysis except that no directional or causal linkage is assumed but merely mutual consistency in the arguments. CCA is actually an essential element of General Morphological Analysis[3] (GMA), a problem structuring method, which we have reported before in this journal[4] that permits the structuring and analysis of high-dimensional problems. Such problem complexes are often non-quantifiable, contain ineradicable uncertainties and cannot be causally simulated or modelled in a meaningful way.

Process description using a pharmaceutical case study

To test the validity of SWOT-MA™ process, an actual case example involving a start-up niche generic firm was considered for the following focus question: "What are the most important factors to secure drug approvals within funding time frame of 3 years". In most cases, regulatory authorities require clinical testing in human volunteers of the generic drug against the original innovator medicine whose patent (or more correctly data exclusivity period) has expired, i.e. bioequivalence studies. In rare circumstances, drugs of 'well-established use' and those that meet certain criteria (BCS Class 1) are given 'biowaivers' particularly if reference can be made to original drug dossier[5].

Figure 1 shows a SWOT we generated to address the problem. In all, 22 factors were identified in the four parameters. This would necessitate that 840 unique

Strengths	Weaknesses
1. Low overheads (e.g. head count) 2. Specialist testing outsourced 3. Simple dosage forms (solutions, creams) 4. Fixed private funds 5. Strong marketing & distribution network 6. Generating income from Specials dealing which funds R&D 7. Contracted out Specials manufacturing	1. Agency theory… 2. Limited experience of team in securing the full process of licensing 3. Limited staff – spread too thin 4. Licensed manufacturing 5. Limited monthly budget/lack of flexibility 6. Limited key equipment e.g. HPLC
Opportunities	**Threats**
1. Further increase Specials operations 2. Diversify into more high-risk, high-reward dosage forms (e.g. suspensions) 3. Seek new indications of existing drugs 4. Ability to raise funding	1. Regulatory guidelines being more strictly interpreted 2. Same drug licensed by another company – reduced market share 3. Bioequivalence trial costs escalate 4. More data required for biowaivers by regulators at Day 105 5. Difficult to obtain original dossiers

Figure 1: A SWOT analysis examining internal and external factors to be taken into account by a niche generic drug firm to ensure drug approvals within fixed funding timeframe (of three years).

configurations be considered by the working group, an onerous task given the lack of time in many organisations and, more importantly, the lack of a dedicated computer software able to capture the pairwise assessments (there are 279 unique pairs for the SWOT alone). Since a 3-dimensional problem (pitting three dimensions against each other) can be represented as X Y Z columns, the four dimensions of a SWOT can easily be converted into a 4-fold morphological field as shown in **Figure 2**.

Strengths	Weaknesses	Opportunities	Threats	Output (Ansoff Matrix)
Low overheads	Agency concerns	Further increase Specials operations	Regulatory guidelines being more strictly interpreted	Market Penetration
Specialist testing outsourced	Limited experience of team in securing the full process of licensing	Diversify into more high-risk, high-reward dosage forms	Same drug licensed by another company – reduced market share	Market Developemnt
Simple dosage forms	Limited staff – spread too thin	Seek new indications of existing drugs	Bioequivalence trial costs escalate	Product Development
Fixed funds	Licensed manufacturing not in-house	Ability to raise private funding	More data required for biowaivers at registration	Diversification
Strong marketing & distribution network	Limited monthly budget		Difficult to obtain original dossiers	
Specials income funds R&D	Limited key equipment e.g. HPLC			
Contracted out Specials manufacturing				

Figure 2: The four parameters of a SWOT displayed as a 4-fold morphological field – or 5-fold if one adds the output. In this example, there are 267 unique pairs and 3,360 simple configurations (a configuration is a string of cells with each cell only appearing once – one shown).

The reader will notice, however, an additional output parameter, namely the Ansoff's Matrix has been bolted onto the SWOT. This is an essential step to make sense of what one is trying to achieve with the SWOT-MA™ exercise, i.e. the output – the principal objective of this paper, and indeed of the SWOT. In this instance, the workshop team concluded that of the wide variety of management models available[6], the product/market diversification model of Ansoff best suited the company's near term aims and current activities (of specialised provision of unlicensed medicines and product registration). A more mature company in its business lifecycle may well have considered another output such as the Horovitz's framework, which evaluates cross-market/sector expansion strategies by pitting the dimensions of the ease of entry vs. cultural fit[7].

For the CCA, the CARMA® software reformats the morphological field into a matrix that easily allows a facilitator (e.g. the project manager) to conduct the exercise with the project team.

Figure 3 displays the CCA – intersecting cells denoted by 'X' were deemed incompatible as assessed by the working group whereas blank cells signified that either the two conditions were compatible, or operated in two different spheres of activity without impacting on each other. The role of objective facilitation and the meaning afforded by comparing different parameter blocks cannot be over-emphasised. In this context, some of the questions asked during the CCA included:

- **Strengths and Threats:** "Can we *overcome* a potential threat in the external environment with our internal strength?"
- **Strengths and Opportunities:** "Can we *exploit* an opportunity in the external environment with our internal strengths?"
- **Weakness and Threats:** "Given our internal weaknesses, how can we *circumvent* external threats?", or "What is the impact on the organisation if the internal weakness reinforces the external threat" (e.g. increased governmental regulation but lack of regulatory personnel within the firm)
- **Weaknesses and Opportunities:** "How can we circumvent an external threat to the project or organisation given an internal weakness?"

Cross-analysing some conditions can become cathartic – for example is it meaningful to compare internal strengths and weaknesses, particularly when such conditions are mirror images that can offset each other? For example, having low fixed costs *(strength)* tolerates the weakness of possessing limited (specialist) equipment (as such assets are relatively illiquid, and require maintenance and service contracts). In other instances, such as pitting weaknesses against opportunities, it becomes a concern: "What is the impact of having limited equipment (a weakness) on the ability to exploit a particular opportunity?" In the first situation, it there is no impact because each

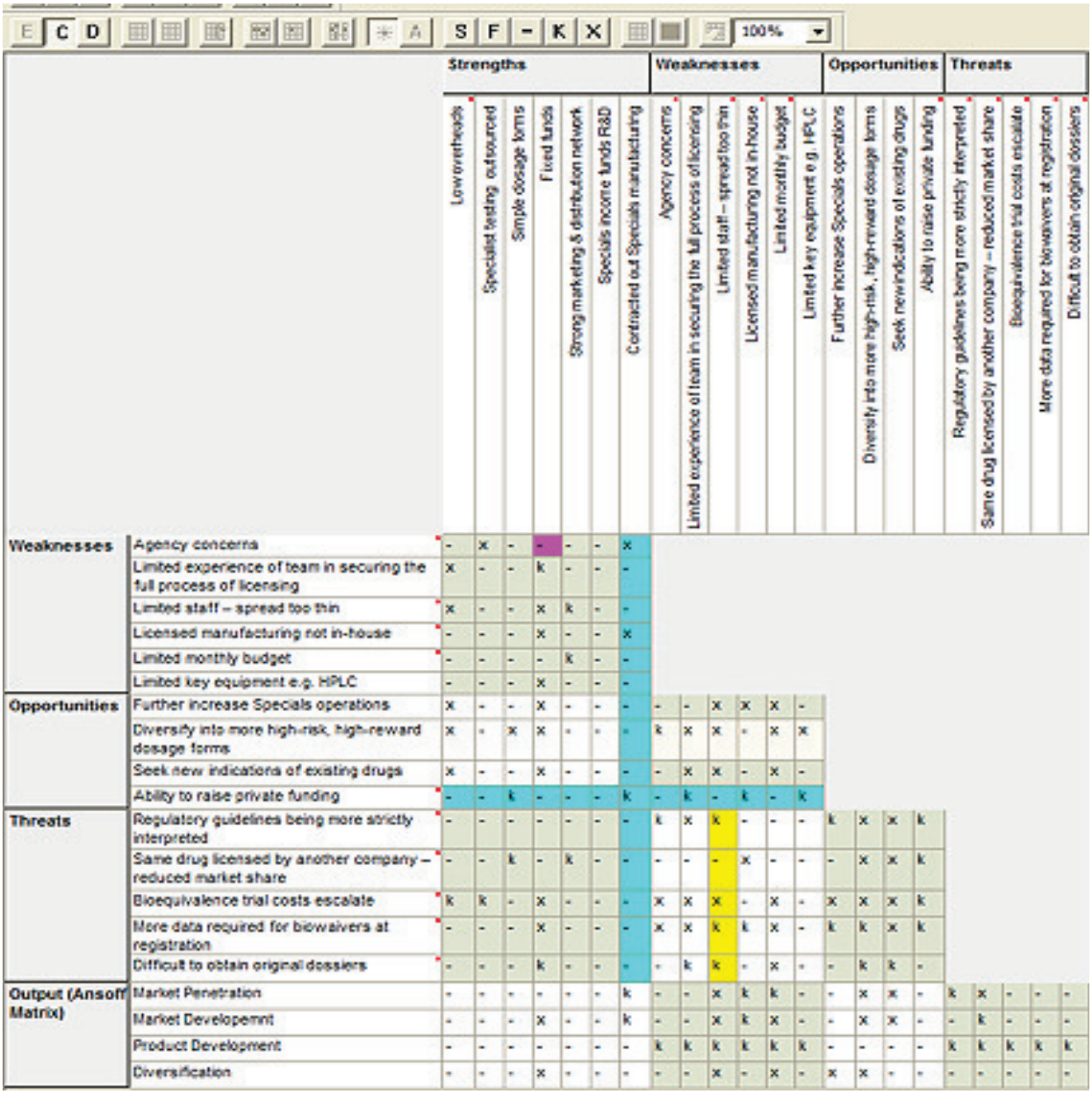

Figure 3: The entire problem space identified in a morphological field can be dramatically reduced by Cross Consistency Assessment. Whereas in a morphological field the number of configurations increases exponentially with each additional dimension (for example SWOT alone gives 840 configurations cf. 3,360 with the addition of the Ansoff column), the number of Cross Consistency Pairs does not increase in proportion (179 vs. 267). For a relatively small morphological field, few tens of pairs need to be 'knocked out' to obtain a manageable solution space.

condition operates in separate set or universe (i.e. the conditions are uncorrelated), whereas in the latter case, there is a meaningful comparison to be made.

Note that a third level of output was also achieved with the use of user-defined keys (K, S, and F), which considered empirical constraints (i.e. conditions that would be possible if one only had enough time, resources, etc). This is an important facet as SWOT is an evolving, dynamic framework that needs to be revisited on a periodic, basis. Using dedicated software, notes can be taken for each intersecting cell such that an electronic audit trial of how the decision was arrived is available for sake of transparency, auditing, due diligence, and timeline analysis.

Picking the winning strategy

Performing the CCA resulted in 23 unique configurations out of a possible 3,360 combinations, a reduction of over 99% of the entire problem space – previous projects have seen a reduction in over 99.9%

with much larger morphological fields that have contained 10^5 – 10^6 configurations. A deeper analysis of strengths and opportunities yielded some expected and more significantly unexpected results. The principal strength was in fact the ability to fund company operations from income being generated from wholesaling and brokerage arm i.e. 7 of the 23 configurations contained the cell *'Specials income funds R&D'* – not particularly surprising given that 'cash is king', especially when a company has a fixed amount of (private) funding. However, at the start of the company's founding, this activity was too readily dismissed, as the market for dealing in Specials (see Box) was considered highly volatile and uncertain[8]. The ability to generate cash naturally allowed all outputs to be considered except 'Product Development', a totally unexpected result (diversification was expected to fall out).

The point here is that multiple scenarios can be considered, the dynamic model can be driven from the desired output (and what would the required inputs to get to the desired output state, i.e. reverse engineering) and more importantly the contrast, i.e. those cells which do not show up. When the inference model was considered in its entirety, a hitherto unconsidered opportunity emerged. Whilst applying for a market authorisation of an unlicensed product, it can be supplied as a Special – this self-funds the submission procedure provided it is within the same disease indication. Such gap analysis is only possible using a very structured and facilitated framework, to which GMA is fully attuned.

Mapping and connecting the entire landscape

Assessing multi-dimensional socio-technical problems amongst stakeholders without experienced facilitation and purposeful software, leads to sub-optimal decision-making and waste of resources. This is not surprising when one considers how teams make decisions without mapping out the entire 'messy' problem landscape. As observed by Michael Pidd in his book *Tools for thinking*[9]: "one of the greatest mistakes that can be made when dealing with a mess is to carve off part of the mess, treat it as a problem and then solve it as a puzzle, ignoring its links with other aspects of the mess."

Early stage companies face three principal types of uncertainties – commercial feasibility, technical feasibility and the managerial ability to execute, particularly when the management team has not worked together before[10]. In such situations, the non-linear connectivity of innumerable factors in a rapidly-changing environment and the subjective judgments when interrelating even the most marginal of factors are rarely captured or facilitated in any meaningful manner.

Conclusion

In this paper, we have attempted to describe how problem-structuring methods such as GMA can vastly improve analytical tools, such as SWOT, in the context of business management. GMA, however, functions upstream in mapping the totality of the problem space by developing an exhaustive inventory of all its possible solutions. By using the CCA procedure, the synthesis of internally consistent multiple solution concepts (i.e. the design space) can be isolated and tested against possible outputs, intended, and unintended, ahead of time.

We believe that such an approach can be applied to other commonly applied business management tools where multiple parameters must be considered. For example the PESTEL framework (an analytical tool to identify different environmental factors affecting business strategies) can be worked in the manner described here to develop the Opportunities and Threats of the SWOT, and the VRIO12 concept (resource capability of the firm that determines its competitive potential) can assess the internal Strengths and Weaknesses. The various configurations that emerge within a smaller solution design space can subsequently lead to the development of possible scenarios, which is the desired output in business analysis and decision-making frameworks.

SPECIALS

Some patients have special clinical needs that cannot be met by licensed medicinal products. So that these special needs may be met, UK law allows manufacture and supply of unlicensed medicinal products (commonly known 'specials') subject to certain conditions, e.g. Viagra liquid suspension is given to neonates with pulmonary hypertension – the original manufacturer, Pfizer, only produce a tablet form, and for a very different condition!

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