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New Product Development in Small Food Enterprises

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Abstract

Purpose – *The purpose of this paper is to demonstrate how small businesses may deploy a formalised Stage-Gate approach to new product development (NPD). The original Stage-Gate framework was modified to better suit a small business B2B environment in the seafood industry, and was subsequently applied to a small vertically-integrated crab catching, processing and marketing business.*

Design/methodology/approach – *This paper uses a case study methodology. The method used at each stage of the Stage-Gate framework, as well as the time and location details, the people and skills involved, and the evaluative criteria applied for NPD are outlined and discussed; and subsequently synthesized in a modified framework.*

Findings – *The modified Stage-Gate approach was shown to be an effective NPD method, allowing for 92 initial product concepts to be narrowed down to three commercially viable and acceptable products, over a period of less than 11 months. Cost and time were minimised by the four-day ideation process. Furthermore, repeated evaluation of the sensory and market acceptability resulted in strengthened confidence in market attractiveness, while ensuring that appearance, portion size and packaging were based on expert market opinion. Moreover, this approach was successfully completed at less than 25% of the cost of the previous unsuccessful NPD undertaken by the firm.*

Originality/value – *This study advances our understanding of how small businesses may use a formal NPD process to increase the success rate of new products, through development of a modified Stage-Gate approach.*

Keywords: *New product development; stage-gate approach; small business; seafood business; case study..*

JEL Classifications: M11; M31

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FoR Codes: 1503; 1505

Introduction

Product innovation is a necessity in today's competitive global food markets (Costa & Jongen, 2006; Grunert & Valli, 2001), where consumers increasingly demand greater variety and higher quality (Jaeger et al., 2003). However, new product development (NPD) is a risky undertaking (Altintzoglou et al., 2010b; Stewart-Knox et al., 2003); a high proportion of new food products developed never make it to market, and approximately 50 to 90% of those that do are 'dead' within a year (Ernst & Young Global Client Consulting, 1999; Morrissey, 2006). When developing new products, small businesses face added disadvantages of limited resources and limited depth and expertise of personnel (Pitta, 2008).

Several approaches to NPD in the food industry have been documented (Rudder, Ainsworth & Holgate, 2001). In an environment where evolving and heterogeneous consumer demands create a need for market orientation across the whole value chain (Grunert et al., 2005), consumer-driven NPD has been implemented as a strategy to address the market uncertainties within the food industry (Altintzoglou et al., 2010b; Grunert & Valli, 2001; Jaeger et al., 2003). However, this approach has been criticised because it does not take into consideration the role of other stakeholders in the food supply chain, such as producers, suppliers and retailers (Costa & Jongen, 2006). Alternatively, the Stage-Gate approach of clearly defined stages, each followed by a gate at which an objectively-based decision is made about progression to the next stage of development, has successfully been implemented in the food industry to build a road map to commercialisation (Patist & Bates, 2008).

Few examples of the application of the Stage-Gate model to the seafood industry have been reported (Altintzoglou et al., 2010b; Morrissey, 2006). Altintzoglou and colleagues (2010b) used qualitative data on consumers' barriers to seafood consumption obtained through focus groups as input for a Stage-Gate approach to inspire the development of new seafood concepts (Altintzoglou et al., 2010b) which were subsequently 'virtually' tested by consumers through a web-based questionnaire (Altintzoglou et al., 2010a). On the other hand, Morrissey stressed the need for Stage-Gate to be thought of as a philosophy rather than a process, and highlighted the need for flexibility and scalability in the process (Morrissey, 2006).

In small business, studies have looked at NPD approaches that suit their specific characteristics (Pitta, 2008), as well as in specific industries like high technology firms (Souder, Buisson & Garrett, 1997), and the chemical and machinery industry (Huang, Soutar & Brown, 2002), however little research has considered NPD in small food businesses (Bhaskaran, 2006) and no studies could be identified for a small business operating in the business to business (B2B) market where customers are food service operators, rather than end consumers.

In the context of a dynamic, competitive market environment (Jónsdóttir, Vesterager & Børresen, 1998), seafood NPD faces specific challenges. The seafood industry operates in a highly differentiated market environment where raw material supply can be volatile and tightly regulated (Grunert et al., 2005), and a more integrated global market has led to more intensive competition (Jónsdóttir, Vesterager & Børresen, 1998). In Australia, the seafood industry is the fifth-most valuable food-based primary industry, with a gross value of production of over A\$2 billion (FRDC, 2011), with small businesses (those with fewer than 19 employees) contributing over 80% of this value (ABS, 2011). Furthermore, the sector faces difficulties raising finance to expand or diversify (FRDC, 2011).

Our study focused on three areas within the literature where limited research has been undertaken, first it looks at NPD in small enterprises; second, within the food industry it considers a B2B context where the target market is the food service industry (notably caterers and function providers) rather than end consumers, and finally it looks at a full process from discovery through to launch. This paper reports the development and trial of a seafood NPD process based on a Stage-Gate approach. The specific research objective was to develop and test a framework for accelerated new product development (NPD) in the seafood industry that could be used by small businesses to increase the success rate of new products in a timely and cost effective manner.

The literature that informed the development of our approach is reviewed in the next section. The research approach is then overviewed and the detailed approach and results at each step of the NPD process presented. The article finishes by discussing the results before drawing conclusions and highlighting directions for future research.

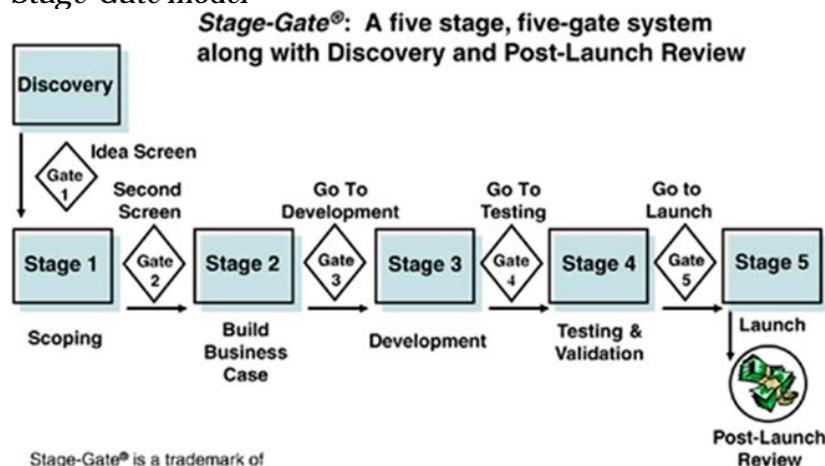
Literature Review

Our case study deploys a formal NPD approach to a small seafood business, governed by Cooper's (2008) Stage-Gate model as a starting point. The Stage-Gate process is a conceptual and operational map designed to move new product projects from idea to launch and beyond (Cooper, 2008). The model consists of a series of stages – designed to gather information – and gates or decision points; it begins with an ideation stage and ends with a post-launch review (see Figure 1) (Cooper, 2008).

This approach was chosen as it is particularly useful because it can be adapted to the small business context, ensures objective decisions are made at each stage of the process, and incorporates a multidisciplinary approach.

Cooper (1994, 1996) identifies four key success factors underlying the Stage-Gate process, including: (1) the importance of cross-functional teams integrating both technical and marketing representatives; (2) the need for a holistic process from idea through to launch; (3) the need for a strong market orientation; and (4) clear criteria for go/no go decisions at each stage. More recently, Cooper (2008) stressed the need for flexibility and adaptability, as well as the need to overlap stages to speed up the process. He further highlights the importance of scalability to cater for different types and sizes of projects. A review of NPD in the food industry supports the relevance of Cooper's criteria (Jaeger et al., 2003; Morrissey, 2006; Stewart-Knox & Mitchell, 2003).

Figure 1:
Stage-Gate model



(Source: Cooper, 2008)

Yet, NPD in small businesses is characterised by a lack of resources, both financial and human (Pitta, 2008), which means the development of cross-functional teams can be problematic. In addition, small business often do not follow a formal NPD process and tend to rely on the opinion of owners and staff, resulting in emotional decisions not based on objective criteria (Pitta, 2008). However, small business may also have advantages in that they are closer to their customers and able to act on customer's insights in a more timely manner than larger businesses (Souder, Buisson & Garrett, 1997). Finally, research has identified that while small businesses may excel in the technical aspects of new product development, the marketing related activities important in NPD are often undertaken less frequently, and are less well executed by small businesses; yet the marketing related activities are important in success (Huang, Soutar & Brown, 2002).

Moreover, the food industry has its own specific problems in managing NPD. Some of these challenges are associated with the fresh nature of the raw materials, often sourced from regional/remote areas. As such, the form/storage capability/shelf life of the product, as well as effective transportation/distribution channels, must be a key consideration. There is also a need to ensure that, with a heightened focus on health, NPD addresses nutritional needs and benefits to the end-user (Earle, Earle & Anderson, 2001).

Although the implementation of new and modified approaches to product development in the food industry has been reported (Altintzoglou et al., 2010a; Stewart-Knox et al., 2003), there is a paucity of published case studies which describe the implementation of a process to develop a new food product from end to end, and provide an indication of market success. Our study will address this gap in the literature by developing and implementing a NPD process based on the Stage-Gate model (Cooper, 2008), with modifications relating to the integration of the different stages and allowances for iterations and repeated evaluation throughout the process (Stewart-Knox & Mitchell, 2003). Thus, the model was consistent with an end-to-end NPD approach (Dahan & Hauser, 2002b), which integrates the different development stages and takes into account environmental influences such as supply chain expertise, time-to-market, and costs (Costa & Jongen, 2006).

The above indicates that a straightforward implementation of the Stage-Gate approach to NPD in a small food business context may be problematic, as many of the original NPD success factors are often challenged in SME implementation, and food NPD in particular. Hence, there is a need to review Cooper's model and key success factors in how they raise potential issues in relation to small food businesses.

Next, we review and modify Cooper's Stage-Gate NPD process to suit a small food business operating in a business to business (B2B) environment. This adapted stage-gate approach is then subsequently applied in a case study where the target market is the food service industry (notably caterers and function providers) rather than end consumers, and looks at a full process from discovery through to launch.

Stage-Gate NPD Framework for Small Food Businesses

Table 1 summarises our proposed framework for NPD in small food businesses. In brief, the first column outlines the steps in the Stage-Gate model, while the second column highlights the challenges specific to small food businesses that need to be incorporated in a revised framework. The third column then summarises the revised approach, while the final column highlights the key adaptations.

Table 1:
Modified Stage-Gate NPD model for small food businesses (adapted from Cooper, 2008).

Step in Stage-Gate	NPD Challenges specific to small food enterprises	Proposed framework for small food businesses	Key adaptations
Discovery	Limited access to personnel and expertise Need to minimise time away from business remoteness	Stage 1 Discovery, Scoping, Business Case	Combines Discovery, Stage 1 and Stage 2 to complete in intensive period and in a central location with access to end-users and experts
<u>Stage 1</u> Scoping	Limited access to expertise/personnel for informed opinion		Use a multidisciplinary team
<u>Stage 2</u> Build Business Case	Distance from end-user Defining criteria for success		<ul style="list-style-type: none"> • Customers • Food experts Tech experts
<u>Stage 3</u> Development	Lack of equipment (or confidence to invest)	Stage 2 Commercial development/ production trial and testing	Outsource to commercial facility
<u>Stage 4</u> Testing and Validation	Distance from potential customers	Stage 3 Market validation	Targeted event with multiple customers (e.g. trade show for chefs/restaurateurs)
<u>Stage 5</u> Launch		Stage 4 Launch	Factory modification, production, verification and launch.

Cooper (2008) highlights the potential of stages to overlap to speed up the NPD process. However, in this revised model three stages: discovery, scoping, and the building of the business case; are undertaken concurrently in one intensive period in a central location with access to end-users and a multidisciplinary team. By combining these stages in a central location, time away from the business is minimised for the small business owner/manager, costs are reduced as time is shortened and travel is minimised by the central location, and the fact that multidisciplinary experts and end-users are more easily accessed. Cooper's Stage 3 Development was modified by undertaking commercial development, product trial and testing in a fully equipped centrally located commercial production facility, rather than on site at the more remote factory location which may lack the required equipment. This again saved time and money by reducing travel costs for the many different experts involved at this stage, as well as ensuring resources were not wasted on equipment that may not be required after this stage. The fourth Stage of Validation became our third stage and was targeted at an industry event. Given the target market was the food service industry, targeting a large trade fair or industry event gave access to many end users in one central location, hence reducing time and cost. The fifth Stage Launch incorporated modification of the business factory to produce the product, final verification testing by members of the multidisciplinary Stage 1 technical team, and launch of the product on the market.

The resulting NPD process includes modifications relating to the integration of the different stages, and allowances for iterations and repeated evaluation throughout the process (Stewart-Knox & Mitchell, 2003). Thus, the model was consistent with an end-to-end NPD approach (Dahan & Hauser, 2002b), which integrates the different development stages, and takes into account environmental influences such as supply chain expertise, time-to-market and costs (Costa & Jongen, 2006).

Research Methodology

Case studies are widely used in organisational studies and social sciences with increasing confidence (Hartley 2004). Yin (2009) stated that in order to illustrate the desired complexity of social phenomena, distinctive case studies are needed because they provide the researcher an opportunity to accumulate meaningful characteristics of events, such as processes or causes, while remaining holistic to the context. It is also echoed by Yin (2009) that the case study method can be applied in situations where the boundary between the context and the phenomenon are not clearly manifested.

This study deploys a case study approach to trial a modified NPD Stage-Gate approach, adapted for the business environment in which the case company operates. The case company previously undertook an unsuccessful NPD exercise in-house to extend its blue swimmer crab product range by utilizing seasonal excess and waste. The NPD process took over 18 months and was costly. Limited resources meant there was no systematic approach to NPD and emotion drove the selection of the new product, that is, the owner and staff developed the new product concept with no formal evaluation or input from customers. Given this negative experience, the case company was eager to be involved in a project that would develop and trial a framework for NPD that would provide an informed basis for the large financial commitment necessary to facilitate production of successful products.

Research design consists of logically combined steps including data collection, interpretation and analysis, which are linked to the research question (Hartley 2004; Yin 2009). Miles, Huberman and Saldana (2014) argued that propositions of the case study guide the data collection sources, and also establish direction and scope of the study, as well as shape the conceptual framework of the study. In our study, the method used at each stage of the framework is discussed, as well as the time and location details, the people and skills involved, and the evaluative criteria applied, as displayed in Table 2.

Table 2:
Methodology and evaluative criteria.

Framework for Food SMES	Method/Venue	Time	People Involved	Evaluative criteria
<u>Stage 1</u> Discovery, scoping, business case	<ul style="list-style-type: none"> Ideation workshop combined with screening and prioritising ideas Small scale cooktop prep (restaurant) 	4 days in a central location (major city)	<ul style="list-style-type: none"> 15 end users 8 technical and business expertise 	<ul style="list-style-type: none"> Rated sensory analysis Technical feasibility Economic/business analysis
<u>Stage 2</u> Commercial development/ production trial and testing	<ul style="list-style-type: none"> Pilot in existing commercial facilities Conduct quality and shelf life analysis 	9 days	<ul style="list-style-type: none"> 8 technical and business expertise 	<ul style="list-style-type: none"> Ability to be upscaled whilst maintaining safety (according to food regulations) and quality as assessed by end-users and sensory analysis
<u>Stage 3</u> Market validation	<ul style="list-style-type: none"> Tasting and survey at Industry trade fair 	5 days	8 technical and business expertise	<ul style="list-style-type: none"> Survey of end-users
<u>Stage 4</u> Launch	<ul style="list-style-type: none"> Factory trials Packaging 	20 weeks	8 technical and business expertise	<ul style="list-style-type: none"> Rated sensory analysis Sales

Stage 1 comprised a four-day process in a central location. Stage 2, Commercial Development, Production Trial and Testing occurred over a four-day period approximately ten weeks after the completion of the previous stage. Ten weeks was the minimum time required to source raw product, fit into the existing schedule of the commercial facility used,

and organise the logistics of technical and expert staff required at this stage. The third Stage, Market Validation occurred at an industry trade show occurring ten weeks after the development stage. The trade fair allowed cost effective and timely gathering of data from industry consumers. Launch occurred a further 20 weeks after the testing and validation. During this period packaging was finalised and factory trials were completed. Next, we report on the research findings of the Seafood Business Case Study.

Research Findings of the Seafood Business Case Study

Case Study Setting

The context for this research was a small seafood business (up to nine staff depending on season). *Abacus* is a vertically-integrated crab catching, processing and marketing business producing a range of products which are marketed to the food service sector. Crabs are caught daily and returned to the processing factory alive, and are then cooked and frozen, as the distance from market (approximately 1,000km) precludes transporting the product fresh. It is noted that *Abacus* operates in a business to business (B2B) market where customers are food service operators, rather than end consumers.

Stage 1: Discovery, Scoping and Business Case

Discovery and scoping

Beginning with a focus on customers, Stage 1 brought together potential customers and the experts to ideate crab ingredients or products presenting viable options, which were worthy of further development and investigation for their commercial opportunity. To improve timeliness, Stages 1 and 2 were conducted over four days at a restaurant in a major city. The chosen venue provided adequate facilities for the discussion and assessment of the ingredients and the developed products, as well as a full commercial kitchen for the development and testing of the concepts. As a large market, Sydney was also convenient for the recruitment of potential ‘expert’ consumers (food service managers and chefs) for this stage.

Three raw ingredients were presented to a multidisciplinary expert panel: crab stock (produced from the crab cooking water), crab mince (produced from extracting meat from picked crab carapaces), and premium crab meat (handpicked from cooked crabs). This panel of 15 (end-user) experts was recruited from a seafood strategy consulting company’s existing commercial contacts, and was comprised of stakeholders from seafood food service and retailer communities, including chefs, restaurateurs, purchasing managers, and menu designers. The expert panel reviewed the raw ingredients both individually and combined, and through idea-generation workshops (Altintzoglou et al., 2010a) developed a series of value added crab concepts. From the creative panel discussions, a total of 92 concepts were developed (Figure 2) on the first day, concluding the scoping step.

Building the business case

On the second day, the concepts scoped the previous day were presented to a ‘technical panel’ comprised of stakeholders from the catching and processing industry (recruited in the same way as members of the creative panel), and researchers. This panel (of eight people) in focus group discussions and subjective (but informed) ratings depending on their expertise, assessed the 92 concepts based on a set of commercial criteria, including viability (based on raw material access, processing and packaging capabilities, and storage

and distribution limitations) and marketability, and prioritised a list of 15 product concepts to be produced and assessed (Figure 3).

These refined product concepts were produced by a team of two professional chefs, and their individual costings determined on the third day. On the fourth and final day, the product concepts were assessed by 11 panellists from the expert and technical teams. A sensory evaluation of each product concept was conducted, using a hedonic continuous line-scale rating ranging from 'Dislike extremely' to 'Like extremely' (Standards Australia, 2005). Panellists were asked to indicate their dislike or like of each product by drawing a mark on a line scaled between 1 and 10 for each of the following sensory attributes: aroma, flavour, texture and overall acceptability. In addition, the 'value' attribute was measured by asking panellists how likely they were to purchase the product at the indicated price (based on preliminary costings). All results were measured and a total out of 100 points was obtained for each attribute. The 15 new products were also compared against four commercially available crab products. The results of the assessments are shown in Table 3, with product concepts listed from highest to lowest based on overall acceptability.

Figure 2:
Concepts ideated during Stage 1.

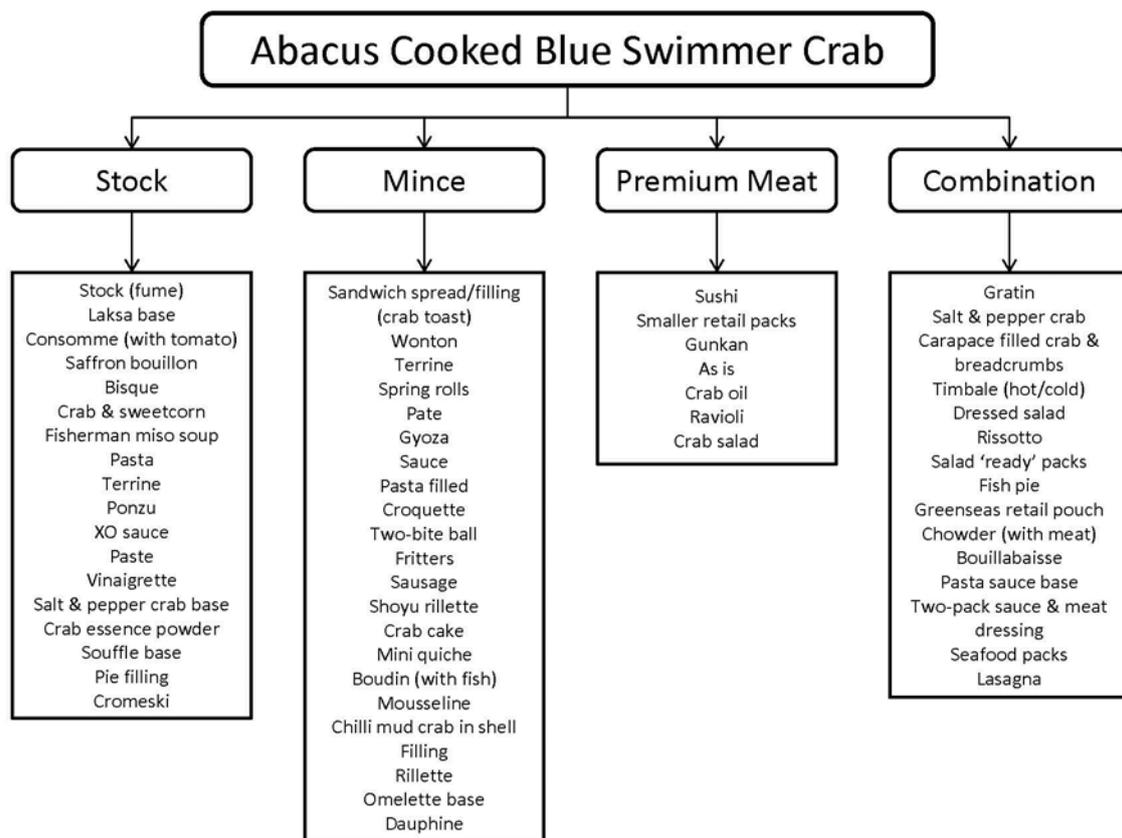


Figure 3:
Concepts developed and assessed in Stage 2 (underlined).

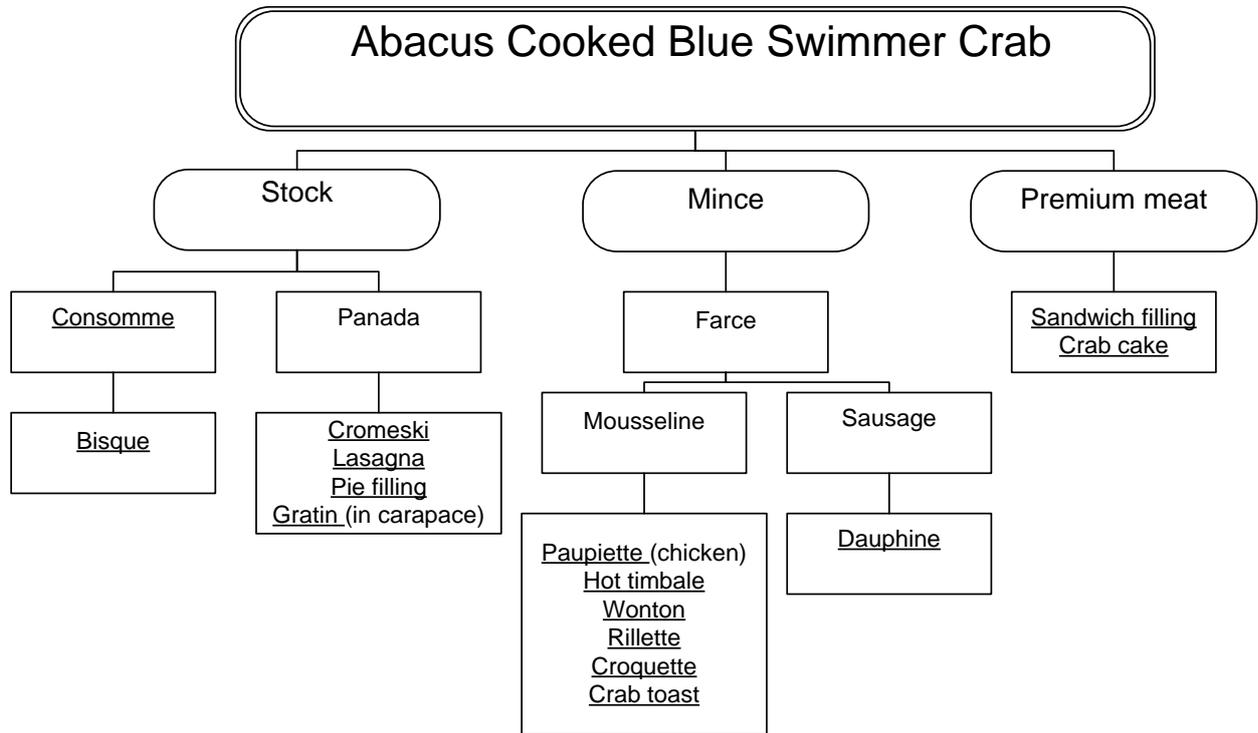


Table 3:
Sensory and value assessment of 19 concept products.

Product concept	Sensory attributes				Value
	Aroma (mean(SD))	Flavour (mean(SD))	Texture (mean(SD))	Overall acceptability (mean(SD))	
Bisque	70.82 (17.79)	79.09 (10.25)	72.91 (14.92)	79.00 (10.05)	72.82 (17.78)
Hot timbale	70.36 (17.71)	76.73 (12.35)	71.82 (12.86)	74.09 (13.05)	72.82 (16.67)
Wonton	77.45 (10.37)	73.82 (9.88)	71.27 (17.38)	73.09 (10.91)	67.18 (8.67)
Rillette	69.64 (8.03)	75.18 (8.13)	71.55 (10.27)	71.45 (4.87)	64.18 (23.67)
Consommé	62.64 (12.93)	70.73 (15.17)	79.18 (13.66)	70.60 (13.16)	65.55 (20.31)
Crab toast	71.55 (14.07)	65.36 (20.58)	71.82 (12.91)	68.55 (16.71)	60.82 (23.65)
Sandwich filling	68.18 (17.87)	69.27 (18.19)	67.45 (21.28)	67.91 (18.49)	55.55 (25.20)
US crab cake	76.91 (9.52)	66.36 (20.73)	71.00 (18.59)	67.91 (17.62)	50.73 (15.53)
Rodger’s crab cake*	64.36 (15.49)	61.45 (14.40)	66.82 (16.02)	67.00 (14.03)	54.00 (22.18)
Lasagne	67.27 (19.42)	62.27 (24.72)	64.27 (22.42)	64.73 (20.41)	53.45 (21.82)
Crab pie	63.36 (13.98)	51.55 (16.81)	59.82 (19.19)	61.55 (15.26)	51.27 (14.62)
Cromeski	57.09 (17.03)	59.55 (20.93)	57.27 (23.28)	58.73 (20.44)	46.18 (21.51)
Dauphine	62.00 (12.43)	53.73 (22.43)	55.73 (15.96)	57.27 (16.46)	51.73 (26.18)
Chowder (Market pride)*	60.91 (26.77)	56.27 (25.90)	52.27 (31.19)	54.91 (28.93)	47.82 (31.62)
Gratin (in carapace)	60.64 (22.51)	54.00 (13.48)	40.55 (20.22)	53.73 (11.69)	40.55 (10.29)
Crab and corn soup*	64.18 (28.62)	48.64 (29.33)	52.36 (25.80)	52.64 (27.88)	45.18 (28.16)
Filled chicken (paupiette)	57.82 (19.84)	44.55 (20.22)	45.82 (20.36)	49.27 (21.79)	54.45 (26.48)
Bisque (Market pride)*	58.36 (19.51)	36.73 (24.57)	49.45 (17.63)	41.73 (20.88)	29.73 (23.59)
Croquette					

The bisque was ranked first in terms of overall acceptability (79.00), while the hot timbale was ranked second (74.09), and the wonton third (73.09). In addition, bisque and hot timbale were ranked first in terms of value (72.82), and were followed by the wonton (67.18) and the consommé (65.55). It is noteworthy that the commercially available products scored considerably lower than the 'new' products.

In terms of the specific sensory attributes, the crab wonton obtained the highest mean score for the attribute of aroma (77.45), followed by the US-style crab cake (76.91), and the crab toast (71.55). In terms of flavour, the bisque obtained the highest score (79.09), followed by the hot timbale (76.73) and the rilette (75.18). The consommé scored highest in texture (79.18), and was followed by the bisque (72.91) and the toast and hot timbale (71.82). The parameters for progression to Stage 2 (commercial production) were: 1) the results of the sensory evaluation and value; and 2) further discussion by the technical team on the long term commercial feasibility of the product being successfully produced at the *Abacus* facility. The seven products selected to progress through to the next stage were: bisque; consommé; hot timbale; rillettes; sandwich filling; US-style crab cake; and wonton. The crab toast, despite ranking highly in the sensory assessment, was not progressed as this product was not considered suitable for production and packaging at the *Abacus* facility.

Stage 2: Commercial Production Trial and Testing

The aim of Stage 2 was to trial production of the seven concepts selected in Stage 1 in a commercial environment, using industrial equipment, ingredients and packaging. This stage was conducted over four days at a commercial food processing company in a major city (and not on location as to undertake such broad range product testing at the *Abacus* factory would have been logistically very challenging, more time consuming and more expensive).

The commercial recipes developed during Stage 1 were rendered into industrial recipes using the commercial equipment, ingredients and processes which would be used going into full large scale production. Benchmark products retained from Stage 1 for each of the product concepts (chef prepared) were used to comparatively assess the impact of large scale production on the structure, aroma, texture and flavour of the products. Continuous retrials of the production were conducted based on changes made to benchmark formulation or process. Eventually, the technical team critically assessed each of the seven final products based on cost, viability, ingredient sourcing, and marketability. The list of products was reduced to five based on ability for cooktop practices to be scaled to commercial production levels, without impacting on product quality. The products eliminated at this stage were the crab wonton and the sandwich filling, as quality attributes were diminished at commercial levels of production.

The commercial recipes for the five products of interest: bisque, cake, consommé, mousseline (presented as boudin and timbale) and rillettes were finalised, and products were subjected to microbiological and organoleptic shelf life testing, proximate composition, food safety and allergen tests, and were packaged and labelled in compliance with the *Australia New Zealand Food Standards Code*, including a Nutrition Information Panel (Food Standards Australia New Zealand, 2011). Interim storage conditions and packaging formats were developed for each of the products. Once the testing had been completed, sufficient product was produced for the testing and validation with the target end-users, that is, professional chefs and food service personnel.

Stage 3: Validation

The aim of this stage was to conduct an extended round of secondary consultation with the target end-users (professional chefs and food service personnel). This consultation consisted of a sensory assessment, accompanied by a self-completed questionnaire. The sample for the testing and validation was drawn from food service professionals who attended a *Restaurant* trade show in Sydney. The *Restaurant* show is an annual trade event attracting a large number of food professionals, where food and wine producers and kitchen equipment suppliers showcase their products. Although a minimum of 50 to 100 people are required to take part in a consumer panel (Meilgaard, Civille & Carr, 2006), the sample size was increased to compensate for the expected higher variability attributable to test environment limitations and the testers' inexperience (Stone & Sidel, 2004).

The data collection instrument used was designed to assess both the sensory attributes of the products and optimise their market aspects. A preliminary draft of the instrument was piloted by an existing trained industry sensory panel, and modified based on their feedback. The sensory analysis test was developed using a rating scale (Standards Australia, 2005) similar to that used in Stage 1. The market research component consisted of questions on costing, usage, and optimal packaging and portion size. An approximate cost for each product was determined by the technical team, and these costings were used as the basis for the possible responses; respondents were given five possible responses ranging from prices lower and higher than the actual product cost, and asked how much they would be willing to pay for the product. The responses to this question would determine price points for the product. With regard to usage, two further questions explored the potential success for the product in the marketplace: 'How likely are you to purchase the product' and 'How applicable is the product to your business?', using a five-point hedonic purchase intent scale (Meilgaard, Civille & Carr, 2006). Respondents were also asked to give their opinion on how they would use the product, preferred portion sizes, and preferred packaging type and volume. In addition, the questionnaire ended with an open-ended question giving participants the opportunity to add any additional comments.

A stand was set up at the *Restaurant* event. A professional chef was hired to prepare all the products selected to ensure consistency. A member of the technical team was positioned in front of the stand to recruit visitors and invite them to take part in the testing, and complete the questionnaire. The mean acceptability rating for each product and each attribute were used to rank the products in order of highest acceptability rating, to lowest acceptability. The final products were assessed by a total of 129 attendants at the *Restaurant* show. The sample mainly consisted of chefs and executive staff. A total of 44.19% of the sample (n=57) were executive staff including owners, directors and managers, whilst an additional 29.46% (n=38) were chefs. With regard to type of establishment, restaurants were the most frequently represented (27.13%, n=35), followed by catering companies (10.85%, n=14) and clubs (8.53%, n=11).

Table 4 presents the results of the evaluations, with products listed from highest overall sensory rating to lowest.

Table 4:
Sensory evaluation testing results.

Product	Sensory attributes (out of maximum 100 points)				
	Appearance (mean(SD))	Aroma (mean(SD))	Flavour (mean(SD))	Texture (mean(SD))	Overall (mean(SD))
US crab cake	81.65 (16.02)	78.99 (17.61)	80.03 (20.15)	81.61 (17.96)	82.37 (17.99)
Crab timbale	68.95 (21.05)	69.56 (20.82)	74.67 (20.01)	70.44 (21.99)	73.84 (19.65)
Crab bisque	72.56 (18.51)	73.48 (18.14)	70.22 (24.10)	72.76 (20.07)	72.85 (20.66)
Crab consommé	67.89 (20.21)	65.55 (20.45)	66.50 (24.56)	70.95 (21.86)	68.54 (22.09)
Crab rilette	62.41 (19.25)	59.73 (19.05)	66.90 (20.97)	64.26 (22.79)	67.07 (19.66)
Crab boudin	61.99 (22.62)	63.80 (22.37)	66.18 (25.13)	63.28 (25.05)	65.99 (23.42)

The US crab cake was the most acceptable product with the highest mean acceptability rating for all five sensory attributes, followed by the crab bisque, crab timbale, crab consommé, crab rilette and crab boudin. The sensory results showed the crab cake rating highest for all sensory parameters assessed. The crab timbale and crab bisque rated next highest across the categories.

Turning to willingness to pay (Table 5), at least 50% of the panellists were willing to pay at the price point or above for the crab bisque (53.70%) and for the US crab cake (50.91%), making them the most valuable products financially. Conversely, the least valuable product was the crab rilette, for which only over a little over a quarter of panellists (26.36%) were willing to pay the cost price.

Table 5:
Willingness to pay results.

Product	Portion size	Cost price	Willingness to pay at price point of above (%)
Crab bisque	220ml	\$4.41	53.70
US crab cake	2 x 35g	\$2.02	50.91
Crab timbale	100g	\$3.09	41.50
Crab boudin	100g	\$3.04	37.39
Crab consommé	250ml	\$4.37	36.27
Crab rilette	100g	\$3.16	26.36

In addition to sensory evaluations and willingness to pay, likelihood of purchase was critical to the decision of which new product(s) to develop. As shown in Table 6, the US crab cake, crab timbale and crab consommé were the three products most likely to be purchased. A total of 70% of panellists indicated that they would probably or definitely purchase the US crab cake, while approximately 50% indicated that they would probably or definitely purchase the crab timbale and the crab consommé. Conversely, the crab boudin was the least likely to be purchased.

Table 6:
Likelihood to purchase.

Product	Likelihood to purchase (%)				
	Definitely not	Probably not	May/May not	Probably	Definitely
US crab cake	3.64	4.55	20.91	40.91	29.09
Crab bisque	5.56	9.26	37.04	34.26	13.89
Crab consommé	6.86	10.78	34.31	36.27	11.76
Crab rilette	3.64	11.82	41.82	36.36	6.36
Crab timbale	5.66	8.49	36.79	33.02	16.04
Crab boudin	10.28	17.76	31.74	30.84	9.35

Taking into consideration the results from the sensory and market research tests, and commercial production limitations and costs, the products chosen to undergo further commercialisation were the US crab cake, the crab timbale and the crab bisque. Market research results on costings, usage, and optimised packaging were used to inform the look of the final products. It is noteworthy that the US crab cake was the bottom ranked product of these seven products in the first stage of the NPD process.

Stage 4: Launch

Following the validation stage which identified three products as having the potential to be developed into new products, one product, the US crab cake, was chosen for commercial production at the Abacus facility. This product was subsequently launched on the market. Following successful completion of the trials and factory modification to facilitate production, 16 pallets of crab cakes (approximately 288,000 cakes) were produced and sold within 3 months. Production runs are ongoing, together with further ongoing market research with buyers. The second product, the crab bisque has undergone market testing, as well as further production and marketing development subject to a commercial partnership between Abacus and a soup company. The timbale is undergoing further product development work to optimise consistency of quality.

In brief, the project was completed in less than 11 months, and for less than 25% of the cost of the previous unsuccessful NPD undertaken by the firm.

Discussion of Results

Several factors contributed to the successful outcome of the product development process described above.

Firstly, this paper demonstrated the importance of anchoring product ideas with sound market knowledge (Stewart-Knox & Mitchell, 2003). This has been discussed previously for seafood NPD in regard to consumer attitudes, knowledge and values (Altintzoglou et al., 2010a). The process described in this paper drew from the expertise and sound knowledge of the market of the seafood service sector throughout the entire development process, from the early ideation and development stages, to the testing and validation stage, which further informed the market feasibility of the new products.

Secondly, this paper highlighted the need for a high quality, unique product, preferably defined in the early stages of the product development process. This is essential in a highly differentiated market characterised by an increasing demand for greater variety and higher quality (Jaeger et al., 2003). In contrast with Altintzoglou et al., who evaluated the product concepts through web-based questionnaires (2010a), the case study described in this paper used sensory analyses throughout the development process to assess the quality of the product concepts. Conducting sensory analyses has been recommended in food product development (Rudder, Ainsworth & Holgate, 2001), and it is a component of the quality function deployment (QFD) approached reviewed by Costa, Dekker and Jongen (2000). In this case study, the sensory assessment not only enabled prioritisation of the new product concepts, but also enabled a sensory comparison with commercial products already on the market early in the development process to ensure a high quality, unique product.

Finally, the presence of a team with a range of expertise contributed to the successful outcome. This multidisciplinary team included the parent company, retailers, suppliers, marketers, researchers, and food technologists, whose participation has been found to be particularly important for product success (Stewart-Knox et al., 2003). The

importance of cross-functional communication and a multidisciplinary team in food development has been noted (Cooper & Kleinschmidt, 1996; Costa & Jongen, 2006; Dahan & Hauser, 2002a). The communication between the ideation and technical teams in this project resulted in issues in both market demand, and technological and feasibility being raised during the initial four day ideation process, and then further tested during the commercial processing trials. Although the literature reports evidence of any association between involvement of senior management and product development success not to be conclusive (Stewart-Knox & Mitchell, 2003), in our case it allowed for rapid, informed decision-making and, thus, contributed to accelerating the development process.

Conclusions and Areas for Future Research

The accelerated product development methodology described in this paper – based on a Stage-Gate approach – has been shown to be an alternative and viable approach for small enterprises in the seafood industry. Cost and time were minimised by the four-day ideation process. In addition, using market expertise (focused on food service market) and technical expertise over a number of iterations, allowed the initial 92 product concepts to be narrowed down to the final three commercially viable and acceptable products, in a period of less than 14 months. The process implemented allowed for a comparison with currently available products during the early stages of development. Finally, the repeated evaluation of the sensory and market acceptability through the development process resulted in strengthened confidence in market attractiveness, while ensuring that appearance, portion size and packaging were based on expert market opinion.

While this study was conducted within a single company in a single industry in one country; the process described could be applied across small businesses in any segment of the food industry. Future research could confirm the applicability of the framework across other sectors in the seafood industry, as well as other food industries. Finally, this study may be the precursor for developing NPD approaches for small businesses across industry sectors.

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