Chapter 7: The New Integrated

Model Doctonaut

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This Chapter describes the radically New & Integrated Model of Piping Engineering Design Management named Deb's Octo-Operated Nauticator or Doctonaut & its working, and features the neoteric knowledge advancement by this research.
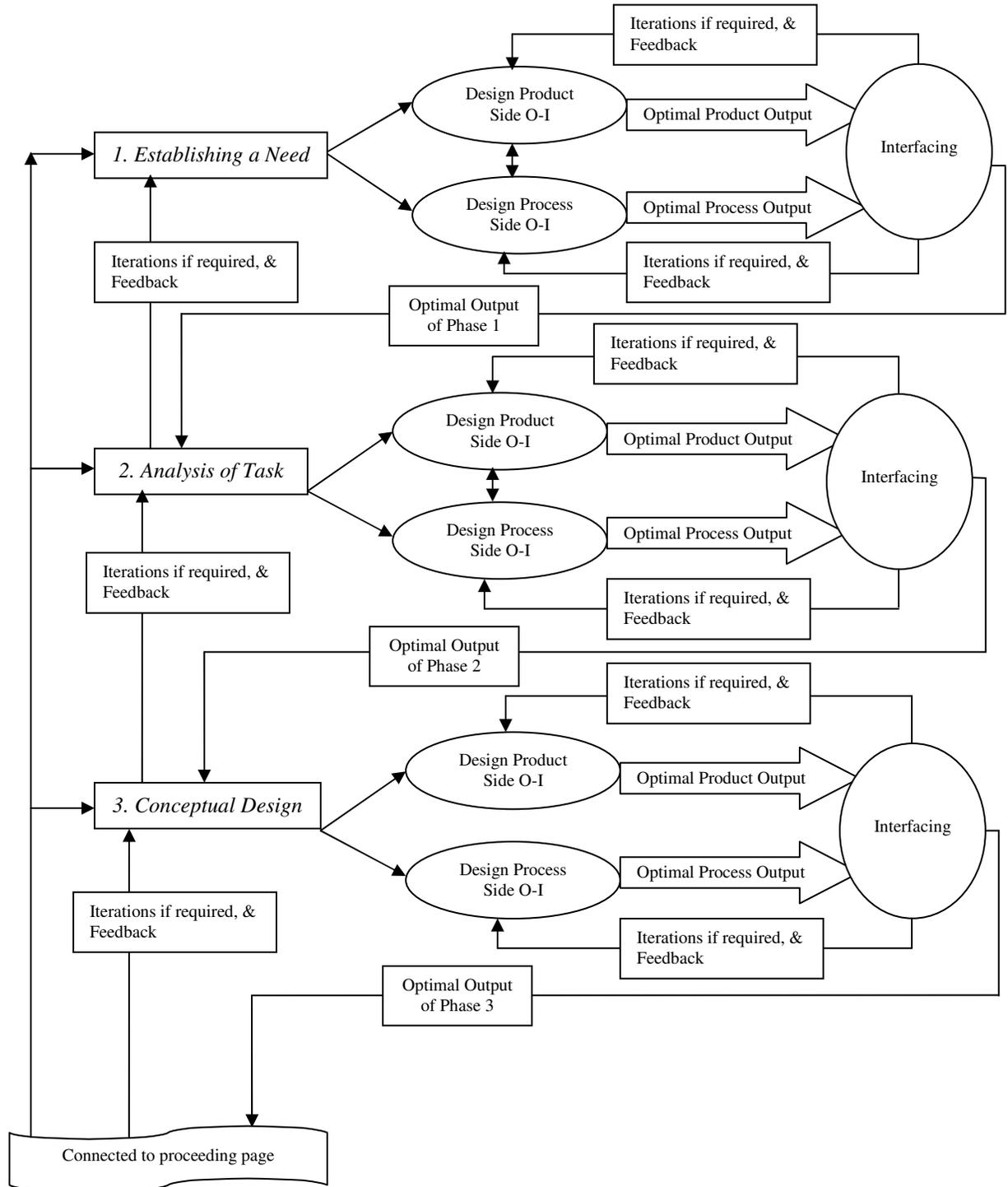
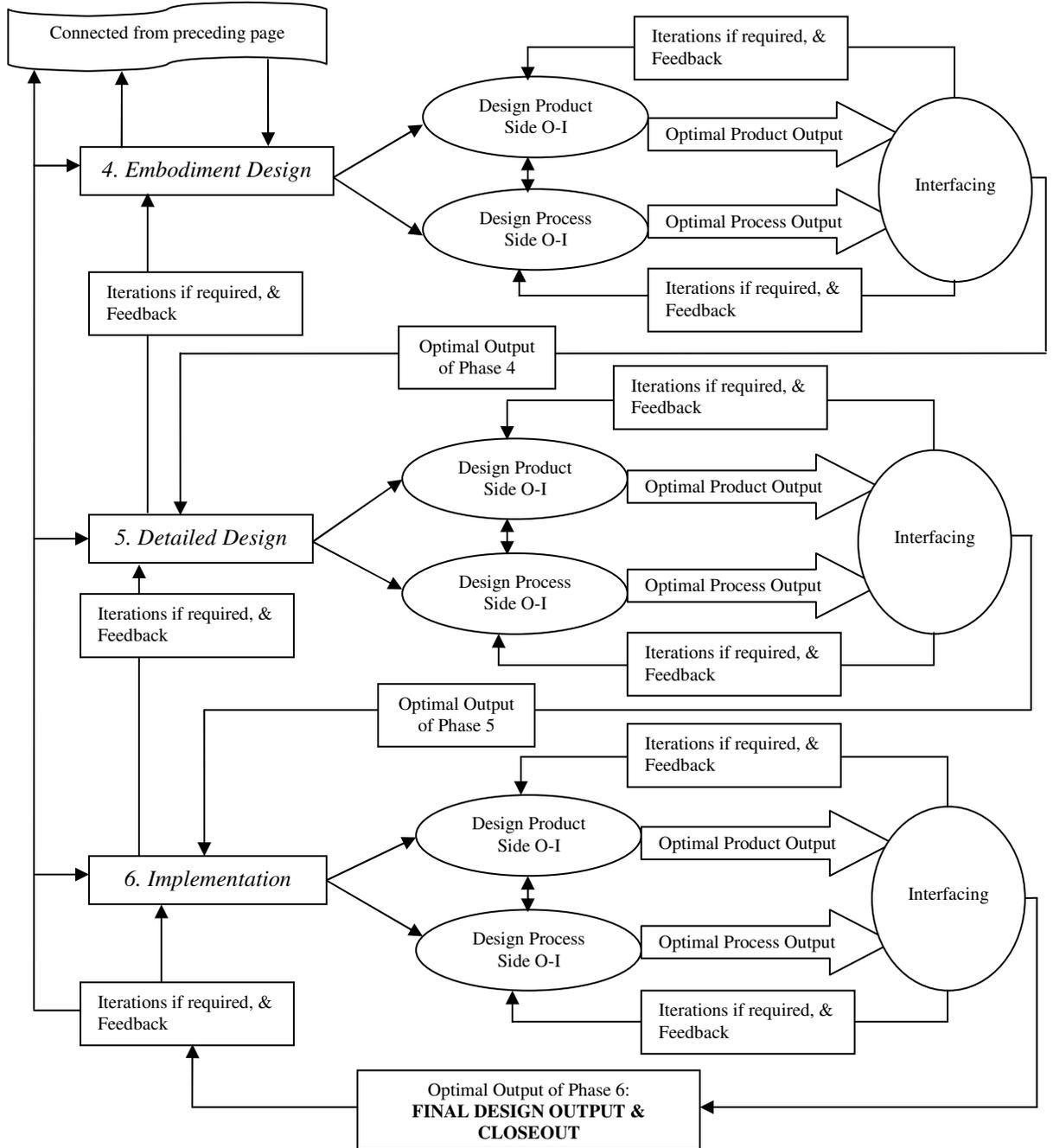**7.1   The Integrated Piping Engineering Design Management Model Doctonaut**

As discussed in the preceding Chapters, it has been described that the Operators need to act on the Owners in specific positive ways in order to ensure the desired outcomes from the PEDM cycle. The following illustrative Figure 7.1 & Figure 7.2 demonstrate the working processes of the model that is proposed from this research work.

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(Figure 7.1 follows in next page)

Figure 7.1: The Operator Integrated Comprehensive PEDM Model, Doctonaut

Connected from preceding page

4. Embodiment Design

Design Product Side O-I

Design Process Side O-I

Iterations if required, & Feedback

Optimal Product Output

Optimal Process Output

Iterations if required, & Feedback

Interfacing

Iterations if required, & Feedback

Optimal Output of Phase 4

5. Detailed Design

Design Product Side O-I

Design Process Side O-I

Iterations if required, & Feedback

Optimal Product Output

Optimal Process Output

Iterations if required, & Feedback

Interfacing

Iterations if required, & Feedback

Optimal Output of Phase 5

6. Implementation

Design Product Side O-I

Design Process Side O-I

Iterations if required, & Feedback

Optimal Product Output

Optimal Process Output

Iterations if required, & Feedback

Interfacing

Iterations if required, & Feedback

Optimal Output of Phase 6:
**FINAL DESIGN OUTPUT & CLOSEOUT**

In the Figure 7.1, the 'O-I' or Operator-Integrator integrates each of the eight Operators for catering to all the issue/challenge Owners (the owners, operators and the individual working details of these Operators have been discussed heretofore in Section 6.1.1 and the integrative workings are described in the following paragraphs). The Operator integrated optimal design output is thus produced inside both the Product Side & the Process Side inside each of the Six Phases of the entire design management cycle, as shown in Figure 7.1, to produce the Final Design Output & Closeout of the particular project's Piping Engineering Design Management Cycle. It can be noted in Figure 7.1 that even though feedbacks are exigently incorporated on each side in each phase throughout the cycle, on top of that, the learnings from errors/mistakes or feedbacks from the current project are ensconced in the closeout stage to be fed back to all relevant steps; then whenever the next project begins, the steps start only from those concerted fed back learnings (the starting keys of any phase/side are those links to the step-specific earlier learnings); this systematically ensures that the same mistakes are never repeated as well as all the past learnings are intrinsically applied for continuous improvement - directly in the competitive edge of the final output product, the employees as well as the company, and, indirectly in its contributions to the country & the world.

Inside the New Model Doctonaut, each O-I shall work through a sub-cycle as depicted in the following Figure 7.2. Therefore, each Side (Product/Process) in each PEDM Phase of Doctonaut, shall have eight sub-cycles as per Figure 7.2. It can be noted that each governing level in Figure 7.2 shall also ensure continuous improvement through learnings from mistakes/errors/feedbacks in the same process described in the preceding paragraph; thus, the past cognitions are consistently ensured throughout each phase, each side and each governing level of the New Model Doctonaut.

Figure 7.2: Each Operator-Integrator (O-I)
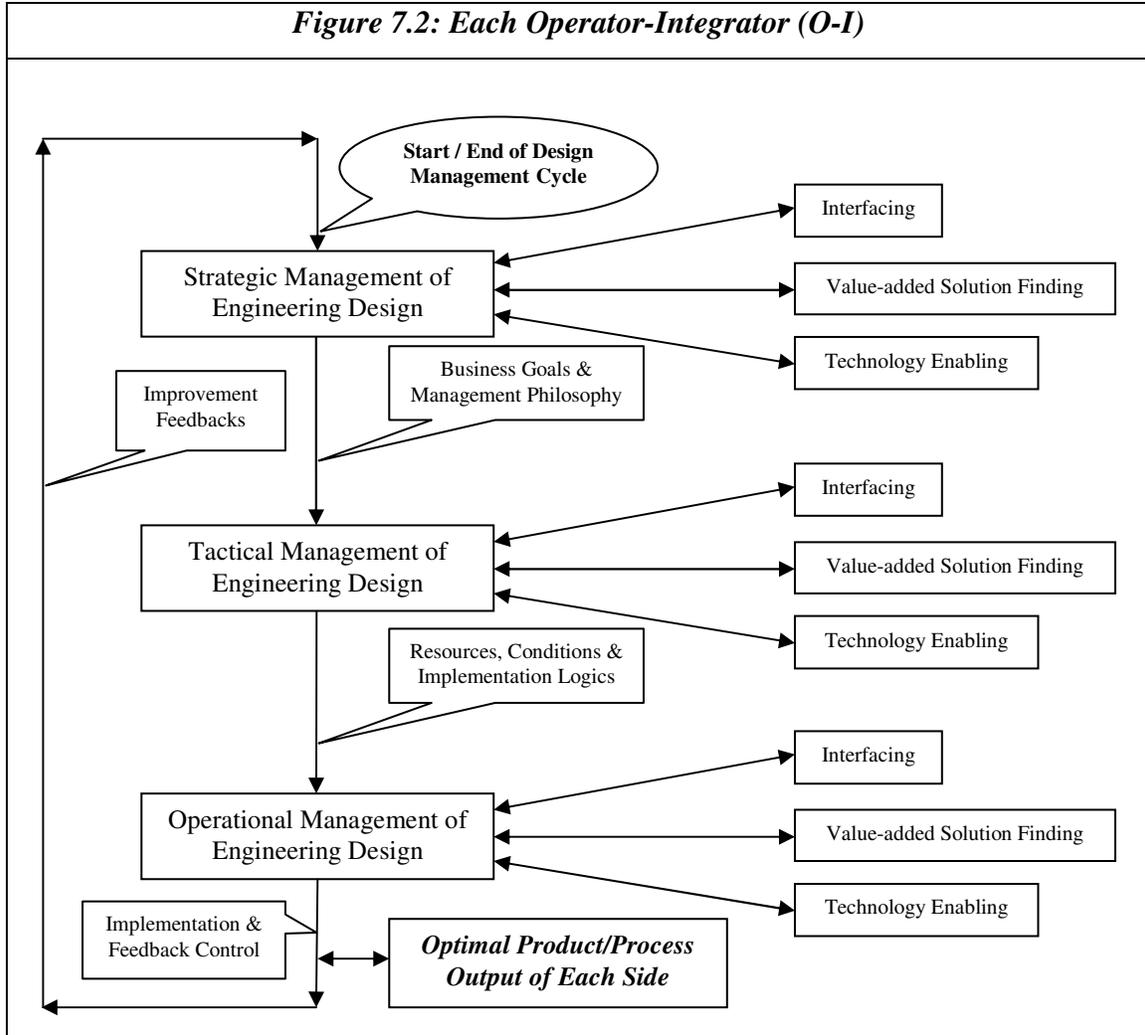
The Figure 7.2: Operator-Integrator (O-I) cycle is similar to the Figure 3.1 basic conceptual framework with suitable modification in the final product output, i.e. Figure 7.2 O-I process produces 'Optimal Product/Process Output of Each Side' of PEDM inside each of the Six Phases whereas the Figure 3.1 is a basic & generic process. The principles and description of this integrator cycle has already been discussed in Section 3.2 and hence are not repeated here. On the other hand, the functioning of each of the eight Operator-Integrators, which shall need to follow some mandatory activities specific to the particular O-I, are described in the following paragraphs.

In the Operator **Objectivity-Ensurer** (O-E), there has to be documented (soft/hard) checks, with only Yes/No check-mark options, for each technical decision in terms of Aesthetics: whether is compliant to sound engineering/management practices, Functionality: whether is able to achieve the desired result/s, Buildability: whether is practically feasible, Economics: whether is potent to give the best quality result among all the other decision options within the budget yet is the cheapest among the similar other options.

In the Operator **Uncertainty-Positiviser** (U-P), there has to be documented (soft/hard) checks, with only Yes/No check-mark options, for each technical decision in terms of Negative Uncertainty: whether negative uncertainty has been analyzed and proper measures put into place to reduce chances to ALARP and in terms of Positive Uncertainty: whether positive uncertainty has been analyzed and proper measures put into place to increase chances to AHARP.

In the Operator **Interdisciplinary-Optimizer** (I-O), there has to be documented (soft/hard) checks, with only Yes/No/NA* check-mark options, for completing each Design Side (Product/Process) in terms of – whether joint reviews of their designs have been done, whether periodical audits of their own designs (at least once even in extremely urgent schedules) as well as each other's designs (before issuing to Client) been scheduled and being adhered to.

In the Operator **Transknowledge-Balancer** (T-B), there has to be documented (soft/hard) checks, with only Yes/No/NA* check-mark options, for completing each Side (Product/Process) in terms of – whether the project specific knowledge (engineering/management related & pertinent to that specific Side) sharing session has been sequenced/scheduled by a senior (GM/CM/SM) for a junior (MLE/DE1/DE2) on an area identified by the senior as weak in that junior, whether the project specific knowledge sharing session has been scheduled by a junior (MLE/DE1/DE2) for a particular senior (GM/CM/SM) on areas identified

by the junior as weak in that senior (for e.g. the junior due to his previous experience, may be in a different company, might possess expertise knowledge on any specific small area like say reinforcement calculations or say design software assessment or say management of change in as-built design, etc. on which the senior may not have had any experience) and whether the sessions' schedules are being complied with.

In the Operator **Multi-integrative-Communicator (M-C)**, there has to be documented (soft/hard) checks, with only Yes/No/NA* check-mark options, for completing each Design Side (Product/Process) in terms of – whether any interdisciplinary/inter-engineering/external conflict has been potentially identified or already reported, whether the stakeholders are sharing their understandings & treating assertions as facts in conflict-resolution meetings, whether technical disagreements are being expressed & being treated objectively in conflict-resolution meetings, whether there are bi-directional communications both internally (among the Design Engineers & the Design Managers) as well as externally (with the Clients) and whether the Company's vision, mission and strategies to achieve the goals been made understood by the seniors to the juniors in terms of that particular Side activities.

In the Operator **Innovation-Integrator (I-I)** there has to be documented (soft/hard) checks, with only Yes/No check-mark options, for each Side in terms of – whether every innovative idea has been analysed closely and objectively by the immediate superior AHARP (As High As Reasonably Practicable) & then been verified by another person, whether he/she (the team members) is thinking of innovative ways on the design and the whole process AHARP and whether periodic audits are being carried out on the documented appraisal of my already given innovative ideas.

In the Operator **Rework-Minimizer (R-M)** there has to be documented (soft/hard) checks, with only Yes/No/NA* check-mark options, for each Side in terms of – whether non-value adding activities are being searched for & reported in every Side and whether those activities have been eliminated from the entire PEDM cycle.

In the Operator **Professional-Developer (P-D)** there has to be documented (soft/hard) checks, with only Yes/No/NA *[1]* check-mark options, for each Side in terms of – whether all required resources i.e. engineers, design trainings, design software, etc. have been made available to each other, whether the past learnings from completed projects being checked upon the applicable Side, whether the development of each member is being periodically monitored & fed-backed upon through clearly defined performance appraisal system for each design project, whether performance is being positively identified & proportionately rewarded and whether non-performance is being positively identified & proportionately fined.

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1 = While Yes or No are the mostly chosen options in all Operator-Integrators (O-Is), Not Applicable or NA may also be required in some special cases; sometimes, one/more operator integrating activity may not be applicable to some specific small design project, for e.g. for a project requiring only a pipe's thickness design, it is not pertinent to have an Interdisciplinary-Optimizer (I-O) activity with Electrical discipline; on the other hand, for a project requiring full piping engineering design shall require the I-O to ensure that the Electrical Wiring/Connections are consistent with those specified in the P&ID by Piping/ Process, to agree on time schedules for both inter-discipline and Client deliveries, etc. The option NA (Not Applicable) can be applied in only the special case of a O-I having a potential to be not applicable, as illustrated in the example. In order to tick an NA, there shall be a mandatory text box to be filled with the justification for rendering latency to that particular O-I for the specific discipline.

7.2 **Neoteric Knowledge Advancement**

This study has reviewed pertinent existing research knowledge and has built a new basic conceptual framework; after that data has been collected and analysed as per a critically chosen research design and the previous research knowledge has been compared to the findings; it has been found that all the earlier identified seven issues are applicable to the Indian oil & gas context and additionally five more issues are found to be plaguing the effective management of piping engineering design. Finally, in line with the research objectives and questions, from the analysed data a brand new model of piping engineering design management, appositely named Doctonaut, has been built encompassing the entire PEDM cycle throughout each of the bi-sided six phases; the initially built basic conceptual framework has been suitably modified, augmented and aptly included as a part of this new model Doctonaut through an Operator-Integrator sub-model; this integrated model Doctonaut has been built extensively catering to all the previous seven issues (from previous researches) that are found to be applicable in the present context as well as the newly identified five issues (from this particular research), catering to a total of all the twelve issues/challenges; thus, this present study substantially adds & advances the existing knowledge in this field of Piping Engineering Design Management. The details are pictorially represented in Figure 7.3.

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(Figure 7.3 follows in next page)

Figure 7.3: Neoteric Knowledge
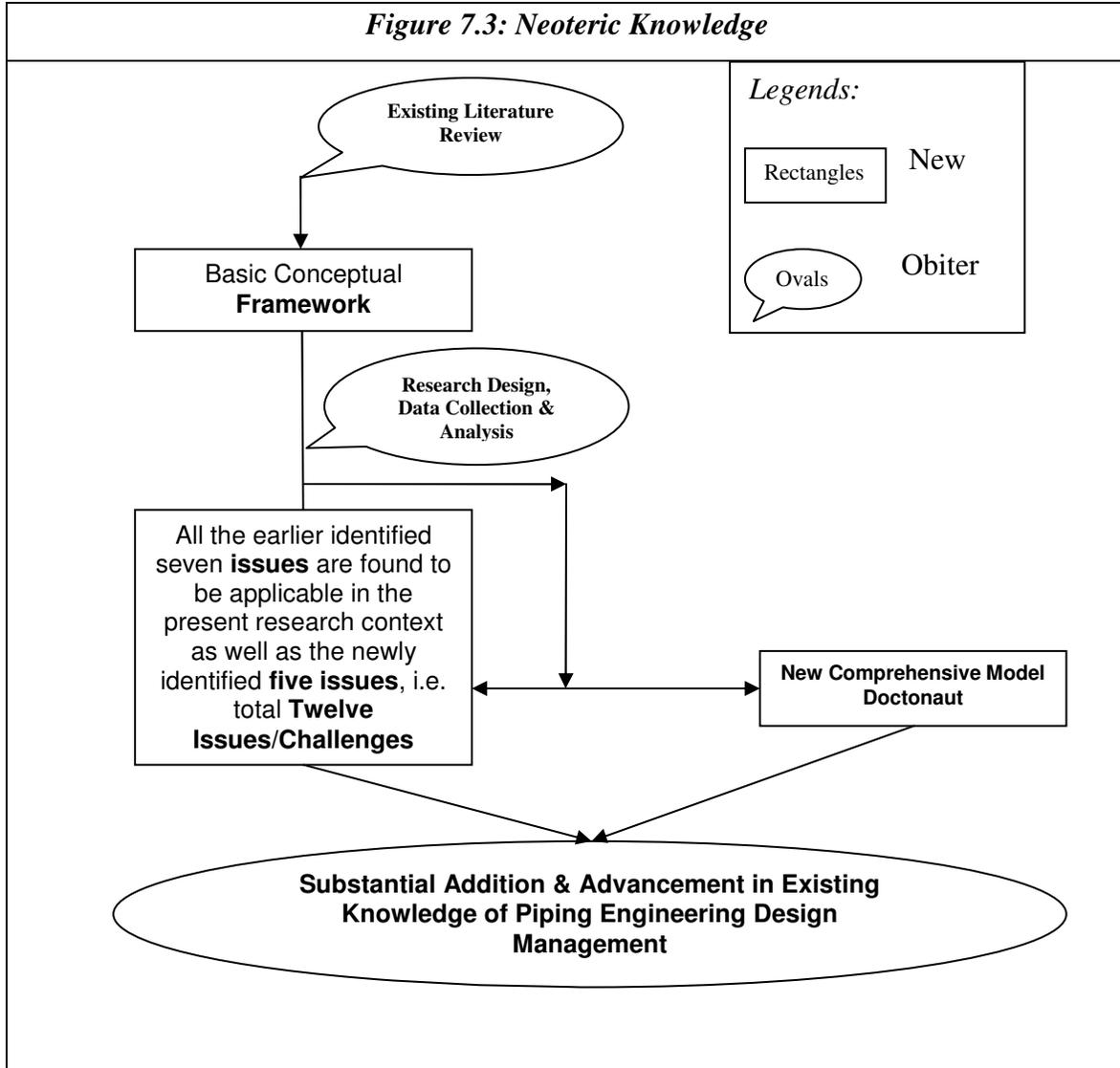
Further, this research work's ***consistency*** *with the research objectives and questions* have been successfully verified as described in earlier Section 6.2. The ***advantages*** of the study's findings, especially the new model Doctonaut, and the elicited potential areas of ***future research*** have been highlighted in the following Chapter.

This Chapter has discussed the integrated operation of the brand new model Doctonaut and has gravitated the neoteric knowledge advancement by this research. The proceeding Chapter wraps up the thesis by providing a glimpse of the key eruditions enlightened through this research study, salient features of Doctonaut, limitations of the study and indicative areas of further research.